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THE ROENTGENOLOGIC DIAGNOSIS OF DISEASES OF THE COLON[1]

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THE most common organic diseases of the colon are neoplasms, diverticulitis, tuberculosis, and chronic ulcerative colitis. The roentgenologic study of the colon in these conditions reveals obstruction of the bariumized medium, abnormal changes in its rate of passage, and transitory or constant deformities in the outline of the colon. Of the diseases mentioned, a differential diagnosis based on pathognomonic roentgenologic evidence can usually be made in only one condition, diverticulitis. In cases of tuberculosis, neoplasm, and chronic ulcerative colitis, the roentgen ray will usually reveal evidence of a lesion, but this evidence is in itself insufficient for a histopathologic diagnosis.

To elicit the roentgenologic signs of colonic disease either the opaque meal or the opaque enema is applicable, and each method has its advocates.

Technique of the Barium Meal

The patient is instructed to abstain from catharsis for a day or two before and during the examination. On the morning of the examining day he is fed a bariumized meal of sufficient quantity to fill, at one time, the cecum and at least a portion of the ascending colon. Every half hour from the sixth to the ninth hour, the colon is examined fluoroscopically and roentgenographically, in an endeavor to visualize the proximal colon at its optimum filling (Fig. 1). Final examinations are made from eighteen to seventy-two hours later, to determine the time of complete emptying of the colon. The patient is instructed to continue his usual habits of eating and exercise, in order to maintain the customary conditions.

Advantages and Disadvantages of the Barium Meal

The advantage of the barium meal lies in the fact that it may be used to reveal the proximal limits of an obstructive lesion in the colon. It will demonstrate the rate of emptying of the bowel. It may be of aid in visualizing proximal portions of the colon which are hidden by redundant loops, during the administration of the enema.

One disadvantage of the barium meal is that in cases of marked stenosis acute obstruction may result from its use (Erdmann). Another, is that when the colon is apparently normal, as shown at exploration or necropsy, it may be impossible to demonstrate a well-filled cecum or ascending colon. Normally, such portions of the gut should be well visualized in from four to six hours after the meal is given (Hertz). However, in some cases these portions are best filled in less than four hours, or in

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more than six hours, and even as late as nine to twelve hours. Furthermore, this examination, conducted without purgation or cleansing of the colon, may reveal pseudo-defects caused by fecal masses. It is apparent, therefore, that this type of examination entails a great amount of labor to the roentgenologist, and may be of considerable inconvenience and hardship to the patient, especially if he is markedly debilitated.

Little aid can be derived from the barium meal examination in lesions of the distal half of the colon. The reason for this is that the barium is not retained in the distal bowel by the normal physiologic retrograde peristalsis, but is visualized ordinarily as a more or less irregularly thinned out strand frequently broken up into separate segments. Haustral sacculation is more pronounced with the barium meal than with the enema. Occasionally the gut may appear almost bisected in places by the deep haustra, and thus small filling defects may not be recognized (Fig. 2). In markedly spastic colons the barium may be thinned, and exhibit a very ragged appearing, narrow segment of bowel, which is practically indistinguishable from an organic lesion. In such cases the enema, administered at considerable gravity pressure, in conjunction with antispasmodics and forcible filling of the spastic segment by manual palpation, usually make a differentiation possible.

Technique of the Barium Enema

The patient is instructed to take 60 gm. of castor oil on the evening prior to the examination, to abstain from the evening meal, and to cleanse the bowel thoroughly with a normal saline enema on the morning of examination. He is permitted to partake of a light breakfast. Formerly a soapsuds enema was used, but on the suggestion of Dr. Louis J. Hirschman that it is irritating because of its excessive alkalinity, and that it probably gives rise to spasm, the saline enema was substituted. The saline, however, has not been used long enough to warrant conclusions.

Fig. 1. Ingested meal at eight hours.

The opaque enema is prepared by stirring 250 gm. of barium sulphate into 500 c.c. of mulcilage of acacia, and adding to this a sufficient amount of condensed milk to make a total mixture of 2,000 c.c. This mixture is warmed to body temperature, and should be of the consistency of ordinary cream; if too thick, it may be thinned by a little water. The air is driven out of the tubing before insertion of the self-retaining syringe nozzle into the rectum. The container is elevated to a height of 30 to 60 cm. above the fluoroscopic table, and the mixture is allowed to flow into the bowel. The administration of this clysma is well tolerated by the patient; it is retained with practically no discomfort, and is rarely productive of colonic spasm. Roentgenograms are made routinely.

Advantages and Disadvantages of the Opaque Enema

Rarely, patients are unable to retain the enema, either because of poor sphincteric control, or because of extreme debility. In such cases the barium meal can be used advantageously in the study of lesions of the proximal half of the colon, or of obstruction of the distal half.

Fig. 2. Appearance of colon after ingested meal. Note deep haustration.

Fig. 3. Small annular filling defect in the transverse colon due to cancer, revealed by the barium enema.

The advantages of the opaque enema are very definite. The entire colon can be filled in from two to ten minutes; thus a roentgenologic diagnosis may often be made at once, and the necessity of repeated examinations be obviated. By expanding the bowel and outlining its contour completely, the enema makes it possible to discover small lesions which would otherwise escape notice (Fig. 3). Hence the mixture should be allowed to flow until the colon appears well distended, and this usually is coincident with the passage of barium through the ileocecal valve (Fig. 4). In our experience the ileocecal valve has been patent in 90 per cent of all cases examined. Other observers report a far smaller percentage of cases in which the barium passes through the ileocecal valve during the administration of the enema. It would seem that this discrepancy might be accounted for in two ways; a more irritating medium is used, or an insufficient amount of fluid is allowed to enter the bowel. If the latter supposition is correct it would readily explain failure to exhibit certain lesions of the colon. The value of the opaque enema is enhanced by its ability to visualize the extent of a lesion more accurately than is possible with the barium meal. The determination of this point is of special importance in deciding the operability in tuberculous cases. Again, whereas the

meal is usually ineffectual in demonstrating lesions in the distal half of the colon, it must be borne in mind that double lesions, both in the proximal and in the distal portions of the colon, may occasionally co-exist (Figs. 5 and 6); it would be exceedingly difficult, if not impossible, to demonstrate this by the barium meal.

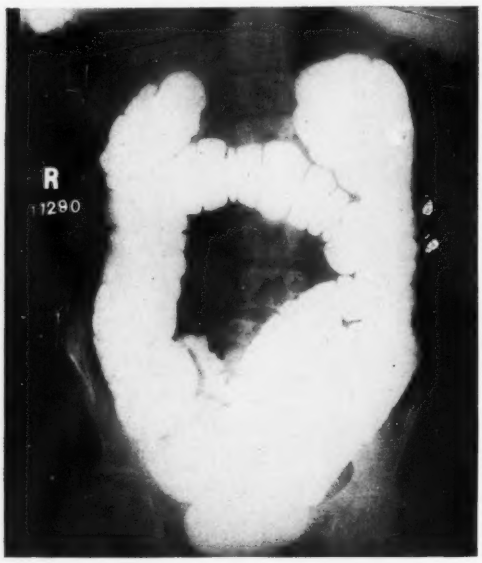

Fig. 4. Colon expanded by clysma, until the barium passes through the ileocecal valve.

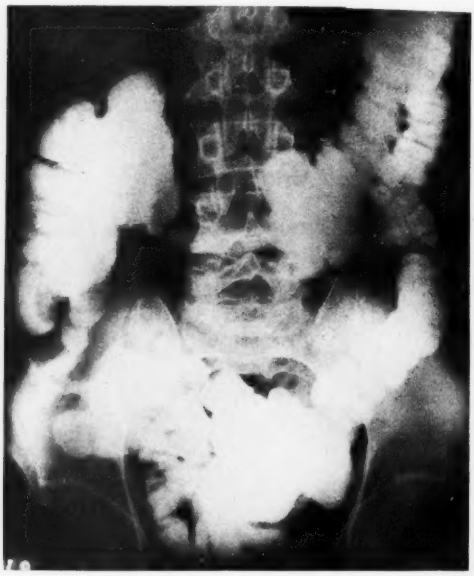

Fig. 5. Colon after enema revealing double lesion; cancer of the cecum and transverse colon.

The proponents of the barium meal emphasize strongly its ability to demonstrate the so-called Stierlin sign, in which an absence of barium in the cecum and ascending colon is noted, while considerable barium is present proximally and distally. But we have seen this phenomenon repeatedly both with the meal and enema in cases of carcinoma, chronic ulcerative colitis, and tuberculosis. The cecum and ascending colon are seen to fill completely, with the exception of such portions of the lumen as are occupied by the proliferating mass. After an interval, varying from a few seconds to a few minutes, this portion of the bowel becomes barium-free. So far as we know, there has been no experimental work demonstrating the mechanism of this phenomenon. Theoretically, this lack of barium retention might be explained on the basis of pathologic infiltration, causing local spasm and loss of physiologic antiperistalsis.

In the Mayo Clinic a fair trial has been given both to the meal and the enema. At first the meal was used exclusively but the surgeons found many lesions which the X-ray failed to discover. The meal and enema were then combined, and results were much better. Finally it became apparent that the meal could be dispensed with in most cases and the clysma used alone. From the viewpoint of convenience to the patient, economy in operation, and efficiency in diagnosis, the enema has proved to be superior to the barium meal. However, the meal is of definite value in certain cases and should be used whenever

thought desirable as an aid or for corroboration in diagnosis.

Morphology and Topography of the Colon

The normal morphologic and topographic appearance of the colon varies within wide limits, in conformity with the habitus of the individual. The tonus of the colon and abdominal muscles during the examination may influence markedly the position of the colon within the abdominal cavity. At the first examination, many patients, frightened somewhat by the darkness of the fluoroscopic room, and apprehensive over the outcome of the examination, find themselves unable to relax, and present a colon spastic in appearance, and situated high in the abdomen. At a subsequent examination, with tonus diminished, the colon is found much lower, and appears more redundant. The colon may be low in the pelvis and yet function normally. It is apparent, therefore, that but little, if any, significance can be placed on position or redundancy.

Usually the colon is broadest at the cecum, narrowing gradually to the sigmoid flexure. The sigmoid, as a rule, is larger than the descending colon. However, many normally functioning colons, which at exploration prove to be without lesions, do not conform to this description, but are practically uniform in diameter along their entire extent.

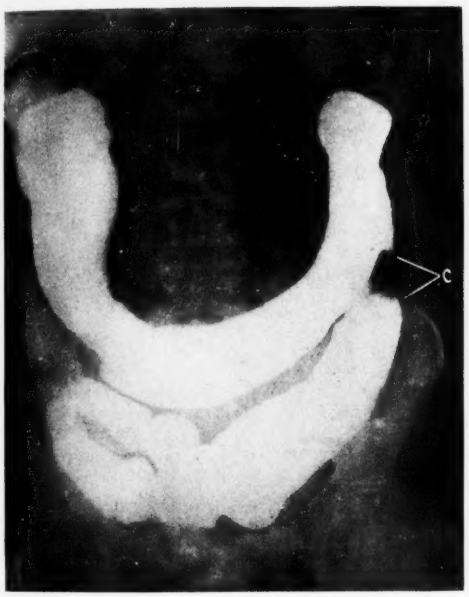

Fig. 6. Double lesion; chronic ulcerative colitis involving the entire bowel; cancer of the descending colon at *c*.

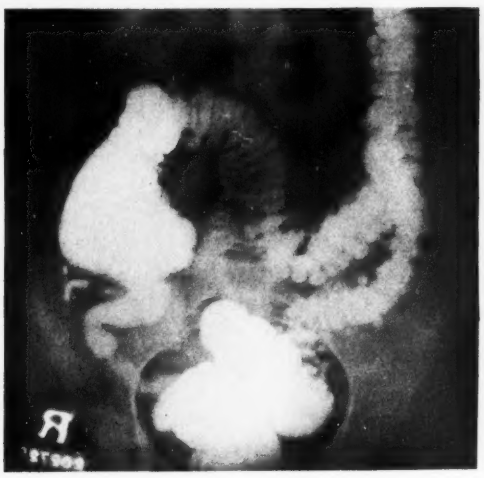

Fig. 7. Extra-luminal shadows revealed by enema; diverticulitis.

The contour of the bowel is characterized by a scalloped appearance, resulting from haustral sacculation. Immediately after distention with the enema this haustration may practically disappear, offering a comparatively smooth outline of the bowel wall which lends itself admirably for study.

The capacity varies with the person and the degree of relaxation of the colonic musculature. In administering the enema the colon can usually be filled with one to two liters of the bariumized fluid. The most satisfactory result is

obtained if a slow filling is continued until the barium passes through the ileocecal valve. When difficulty in outlining the intestine is experienced because of spasticity, the oral administration of belladonna to physiologic

Fig. 8. Barium-filled diverticula ninety-four hours after ingestion of meal.

effect is sufficient to eliminate the spastic manifestations, in the absence of intrinsic organic lesions.

Palpation and observation during the entire period of filling, is of the highest practical value. We have found the use of wooden spoons and leaded gloves unsatisfactory for such examination. The bare hand, or the hand encased in a soft leather glove, makes possible a much finer degree of palpatory manipulation. Twenty years of experience with this method by one of us (Carman) has not resulted in injury to the hands. The intestine, with the exception of the portions lying in the pelvis and underneath the ribs, is fairly mobile to the palpating hand. The splenic and hepatic flexures, usually overlapping and lying underneath the ribs, can often be separated by pressure over the ribs, and by turning the patient slightly on the side. These loops are quite likely to be high under the ribs in enteroptotic individuals, but it is in such persons that the thoracic cage is the most pliable.

Fig. 9. Filling defect in the upper border of the transverse colon; benign papilloma.

The greatest difficulty is encountered in the examination of the pelvic colon. Altering the patient's position from side to side, and to the Trendelenburg position, is very helpful. By close inspection during the filling process, and palpation of accessible portions of the pelvic colon, one can usually observe filling defects, which may later be entirely obscured by redundant loops of the sigmoid.

The position of the cecum varies widely. It may lie very low in the pelvis and be obscured by loops of the sigmoid, or, because of congenital malposition, it may lie behind any portion of the bowel and be inaccessible to observation after the enema. In such cases the barium meal may be of value.

The motility of the bowel, as studied after the barium meal, may reveal a markedly rapid emptying, or a delay. Ordinarily, the opaque medium leaves the colon in from twenty-four to forty-

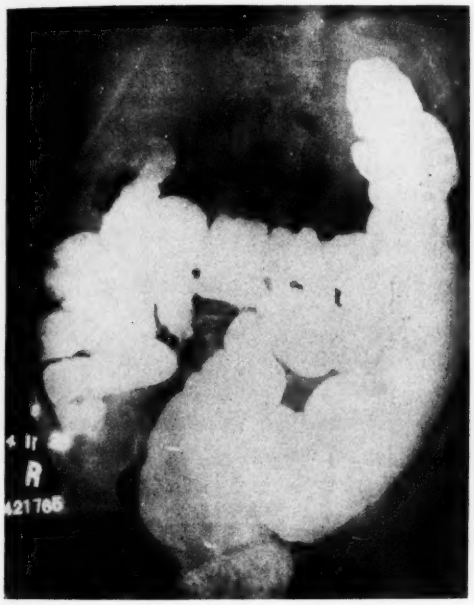

Fig. 10. Filling defect in the proximal colon; polyposis.

Fig. 11. Cancer of the cecum. Note non-retention of barium in the ascending colon; Stierlin's sign.

eight hours. However, in apparently normal persons, who had not been purged, the colon has been found free of barium in much less than twenty-four hours. In cases of gastric malignancy, duodenal ulcer, achylia, and diarrhea, marked hypermotility has often been noted. On the other hand, a considerable amount of barium is often seen in patients who had had a barium-ized meal seven to ten days previously, and who did not complain of constipation. It is evident, therefore, that one cannot draw definite conclusions from the rate of passage of barium through the bowel, and, consequently, motility in itself is of limited value in diagnosis.

Because of the comparative infrequency and slowness of colonic peristalsis the observer is not likely to gain much information from it during the time spent in the routine roentgenologic examination. It is evident, therefore, that a specific diagnosis of lesion of the colon must be based on evidence of obstruction, or on abnormal changes in the contour of the lumen. Deformities of contour are caused by neoplastic growths, hyperplastic inflammatory processes, ulcerations, and intrinsic spasm. Similar deformities may also at times result from direct pressure exerted by adhesion bands, or masses extrinsic to the colon.

Diverticulitis

Diverticula are most common in the sigmoid and descending colon, but may occur along the entire extent of the large bowel. They vary in number from one to several hundred, and in size from two to fifty millimeters or more in diameter. As visualized with the roentgen ray they may be variously shaped, but usually appear as round, ovoid, ses-

Fig. 12*a*. Filling defect in the upper sigmoid; cancer.

Fig. 12*b*. Filling defect in the sigmoid resulting from tuberculous salpingitis.

sile, or pedunculated shadows projecting from the lumen (Fig. 7). Associated with these extraluminal shadows there may be spasm, narrowing, and defective filling of the bowel, along the portion involved. At times there is so much spasm, distortion, and obstruction, that the diverticula are indistinguishable as such, and differentiation from other lesions is impossible. Rarely double lesions, such as carcinoma on diverticulitis, or tuberculosis on diverticulitis, are seen.

Either the barium meal or the opaque enema may be used in the demonstration of diverticula. The meal may be advantageous in demonstrating barium-filled sacs persisting long after the main mass of barium has passed from the bowel (George and Leonard) (Fig. 8). An examination of the bowel, after evacuation of the liquid enema, may reveal a similar picture. The enema given until the colon is well distended, or until the barium passes through the ileocecal valve, is probably the more efficient of the two methods for two reasons:

1. With the meal, or with an improperly administered enema, small amounts of barium may be pent up in contracted haustra of a normal colon, thus simulating diverticulitis. However, with the bowel expanded under pressure of the enema, they are not likely to lead to a mistaken diagnosis.

2. The liquid enema injected under gravity into a cleansed bowel and aided by a massage over the colon is more likely to penetrate minute or stenotic inlets, than the more viscid mixtures of barium.

Roentgenograms made before the barium is administered may aid in distinguishing diverticula from the confusing shadows cast by phleboliths, calcified glands, and stones in the kidney, ureter or gall bladder. Occasionally both the meal and the enema may fail to reveal the diverticula. Usually, in these cases, there is a persisting localized spasm with slight distortion of the bowel which is not relieved by belladonna.

Fig. 13*a*. Filling defect in the cecum; carcinoma.

Fig. 13*b*. Filling defect in the cecum; appendiceal abscess.

Neoplasms of the Colon

Benign tumors are rare (Fig. 9). Their roentgenologic differentiation in most instances is impossible. In diffuse polyposis and multiple adenomata there may be irregularity of outline (Fig. 10), and after partial emptying, or with partial filling and approximation of the walls by palpation, the peculiar mottled appearance, due to the polypi, may be seen.

Malignant tumors are commonly associated with a palpable mass at the site of the defect in the bowel. The irregularity of contour is produced by intrusion of the newgrowth into the lumen, and by malignant and inflammatory infiltration and ulceration of the bowel wall, resulting in stiffening, inexpansibility and spasm. Often the only evidence elicited is complete obstruction to the flow of the clysmal current. The distal end of the barium column is usually seen to terminate in a ragged or conical projection. Schlesinger has shown that this projection may be hidden by the distended overhanging end of the bowel; by a change in position of the patient, or by manipulation, it can usually be brought into view. In cases of obstruction the barium meal may advantageously indicate the proximal limit of the neoplasm. The barium meal, however, may pass readily through the stenosed lumen, without revealing the lesion, and in these cases the bowel may offer a complete block to the enema, and thus reveal the deformity. Occasionally in cases in which lesions involve the cecum and ascending colon there is partial or total nonretention of the barium in the proximal portion of the bowel shortly after the completion of the enema (Fig. 11).

The differentiation of an intrinsic lesion of the colon from deformities resulting from spasm, gas, fecal accumulations, fecaliths, bone pressure, extrinsic tumors, pregnancy, cysts, ascites, adhesions, congenital bands, and adjacent inflammatory processes (Fig. 12, *a* and

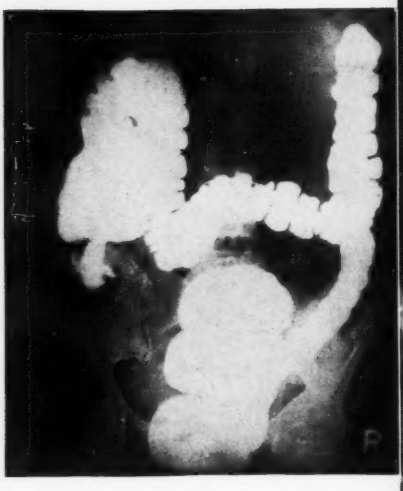

Fig. 14*a*. Filling defect; carcinoma of the cecum.

Fig. 14*b*. Filling defect; tuberculosis of the cecum.

b) is ordinarily not difficult, if these possibilities are kept in mind. Manipulation and changes in the patient's position are of great aid. Repeated examinations, and the use of antispasmodics in physiologic doses, will often aid materially in such differentiation. Not infrequently, however, intrinsic lesions, such as appendiceal abscess (Fig. 13, *a* and b), cecal abscess, actinomycis, tuberculosis (Fig. 14, *a* and *b*), localized chronic ulcerative colitis, and diverticulitis cannot be differentiated roentgenologically from neoplasms.

In a series of 359 cases roentgenologically examined (Carman) in which operation was performed, a diagnosis of a lesion was made in 90.87 per cent; in 9.13 per cent the presence of a lesion was not demonstrated. Diagnostic error is responsible in part, but we are convinced that certain tumors of the colon are not revealed by the roentgen ray. Recently we examined a patient in whom carcinoma of the cecum had been discovered on exploration elsewhere. There was no roentgenologic evidence of a lesion. A second examination again failed to disclose evidence of a pathologic condition. At operation W. J. Mayo resected a carcinomatous cecum. Lockhart-Mummery, and others, have also noted the occasional absence of roentgenologic evidence of tumor of the colon.

Chronic Ulcerative Colitis

Chronic ulcerative colitis is a disease of unknown etiology, characterized by redness, thickening and infiltration of the mucosa of the colon, with subsequent formation of granulation tissue, polypi, pedunculated papillomata, contraction,

induration, chronic ulceration, and perforation. Usually the disease begins distally, and progresses proximally until it involves the entire colon. The characteristic roentgen-ray finding is a generalized narrowing of the lumen, which may be extreme in places. The contour of the bowel wall appears smooth and unhaustrated, resembling a gas pipe (Fig. 15) or a string of sausages (Fig. 16). The enema usually fills the colon rapidly. The contracted areas are not affected by antispasmodics, although the contraction may be exaggerated considerably by spasm, resulting from the lesion. The extent of the disease is usually greater than is manifested by the roentgen ray. In some cases, the findings are so characteristic that a histopathologic diagnosis can safely be made by the roentgenologist. In the earlier stages of the disease, when the process is localized, it may simulate stricture, diverticulitis, or malignancy. Rarely the process may be confined to the proximal colon, and be indistinguishable roentgenologically from tuberculosis (Fig. 17). Occasionally absence of the barium shadow in the cecocolon, so commonly seen in tuberculosis, has been noted.

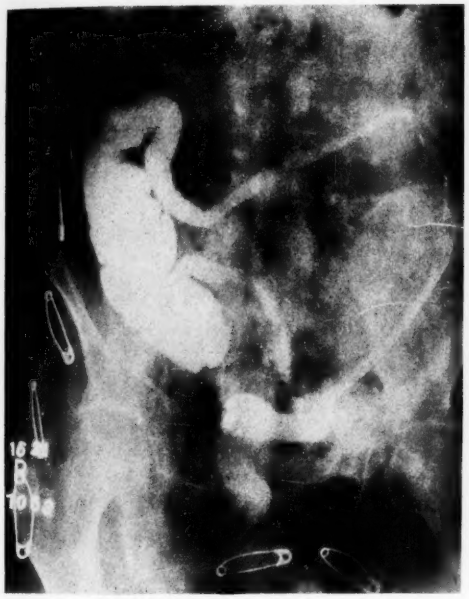

Fig. 15. Chronic ulcerative colitis. Note marked contraction of the colon.

Fig. 16. Chronic ulcerative colitis with markedly contracted areas resembling a string of sausages.

Tuberculous Colitis

Since 1914, thirty-four cases of tuberculous enterocolitis have been explored at the Mayo Clinic. The roentgenologic diagnosis of a lesion was correct in thirty of these. Three, of the four errors, were made prior to 1918 and one in 1920. Three were errors of omission, and one, of commission. The lesions were practically all found in the proximal half of the colon; in two it was found in the sigmoid and rectum.

These data emphasize the well-known fact that tuberculosis in the majority of

instances attacks the proximal half of the colon. The lesions produce obstruction and abnormal filling of the bowel. The obstruction may be partial or total. In some cases the filling defect results

Fig. 17. Chronic ulcerative colitis involving the proximal bowel.

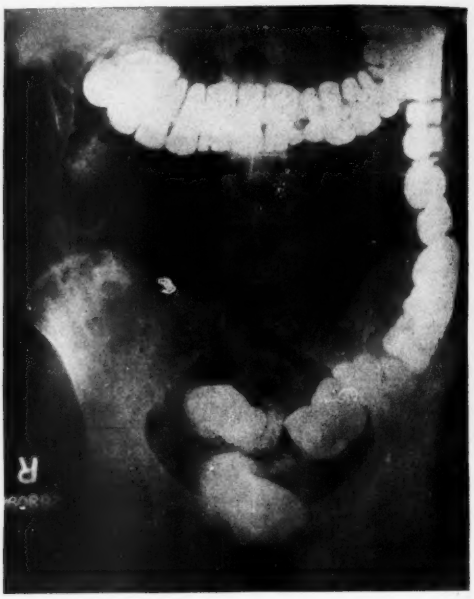

Fig. 18. Non-retention of barium in the proximal colon; tuberculous enterocolitis.

from organic encroachment on the lumen. In others it results from spasm and non-retention of bariumized medium (Fig. 18). These phenomena are in no way different from those produced by other diseases and therefore are not pathognomonic for tuberculous colitis. As a rule, in the presence of pulmonary tuberculosis, evidence of a lesion in the proximal half of the colon justifies the assumption that the colonic lesion is also tuberculous. Such an inference is not always correct, because at operation and necropsy pulmonary tuberculosis associated with a carcinoma of the colon or chronic ulcerative colitis, have been found.

On the other hand, one is not justified in assuming that the absence of a demonstrable tuberculosis of the lungs eliminates the possibility of colonic tuberculosis. In a number of explored cases in which either no evidence of pulmonary tuberculosis was seen with the roentgen ray, or in which, at necropsy, only an old scar of an arrested pulmonary tuberculosis was found, far advanced tuberculosis of the colon existed.

Tuberculosis may be superimposed on another disease, such as diverticulitis. And finally, deformity of the cecocolon, simulating tuberculosis, may result from such intrinsic and extrinsic lesions as actinomycosis (Fig. 19, *a* and *b*), cecal and appendiceal abscess, postoperative calcareous ligature defects, congenital or inflammatory adhesion bands, and pressure from extrinsic tumors and inflammatory processes.

Occasionally the surgeons in the Clinic have found difficulty in distinguishing cecal tuberculosis from carcinoma, even at operation. In view of this, roentgenologic diagnoses are limited to

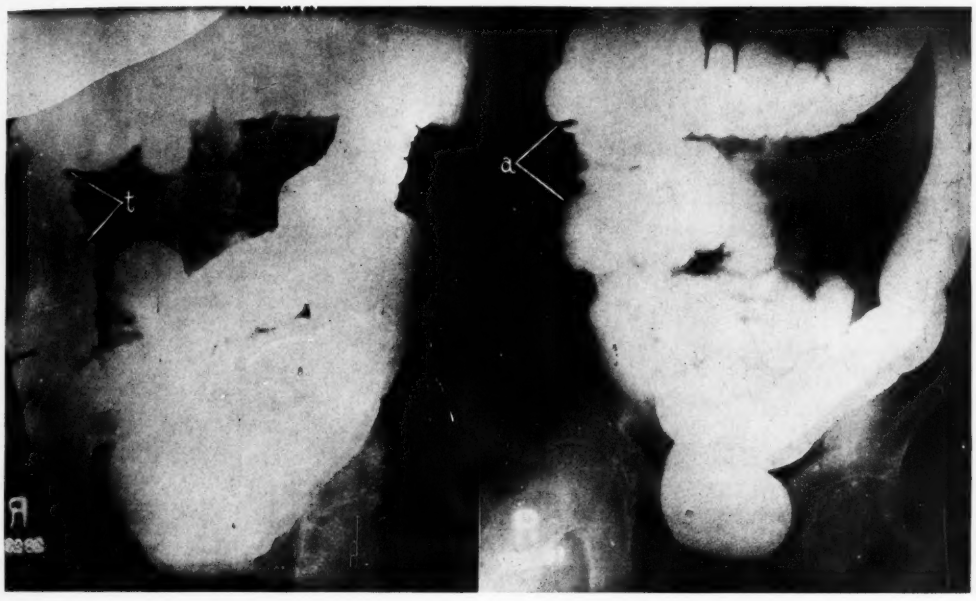

Fig. 19*a*. Tuberculous colitis at *t*.

Fig. 19*b*. Actinomycosis at *a*.

the actual shadow phenomena observed, and a final diagnosis is based on a correlation of all known data, but sometimes a specific diagnosis cannot be made with assurance until a histologic examination has been made of tissue removed at operation.

For the demonstration of tuberculous colitis certain observers prefer the meal to the enema. With the enema alone we have found it possible to visualize tuberculous lesions with a high degree of accuracy. As a result of the filling and distention of the entire colon, very small and early lesions are revealed. The limits of the diseased part are more accurately outlined, and tuberculous lesions of the distal colon, up to and including the rectum, can be exhibited. The meal is employed rarely, and only in cases in which the findings are not entirely clear cut, and in which added evidence is thought desirable.

SUMMARY

1. At the Mayo Clinic the barium enema has been found of greater value than the ingested meal in the diagnosis of diverticulitis, neoplasms, tuberculosis, and chronic ulcerative colitis.

2. In 90 per cent of the cases examined the filling of the colon is continued until the barium mixture passes through the ileocecal valve.

3. Antispasmodics in physiologic doses are made use of in cases in which spasticity is present.

4. A non-retention of the barium in the cecocolon shortly after its filling with the bariumized mixture has been observed in carcinoma, tuberculous and chronic ulcerative colitis.

5. Frequently lesions can not be detected unless deep palpation and approximation of the bowel walls is resorted to during the fluoroscopic examination.

6. The bare hand, or the hand encased in a soft leather glove, enables

one to palpate most satisfactorily and accurately.

7. Motility has been found of very limited value in the diagnosis of colonic disease.

8. Very small lesions, the extent of the lesion, and lesions in the distal half of the colon, can usually best be demonstrated with the barium enema.

9. Roentgen evidence is pathognomonic in the majority of cases of diverticulitis, and in many cases of chronic ulcerative colitis.

10. Tuberculosis and carcinoma of the colon do not present pathognomonic evidence—however, roentgen ray findings usually justify a diagnosis of a "filling defect" or "lesion."

11. Double lesions of like or unlike pathologic character occur in the colon.

12. Roentgenologic diagnoses of diseases of the colon should as a rule be limited to actual shadow phenomena observed—a final diagnosis must be based on a correlation of all known data, but sometimes a specific diagnosis can not be made with assurance until a biologic examination of tissue removed at operation has been made.

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BOOK REVIEW

Clinical Roentgenology of Diseases of the Chest, by H. Wessler, M.D., Adjunct Physician and Associate Roentgenologist, Mt. Sinai Hospital, and Leopold Jaches, M.D., Roentgenologist, Mt. Sinai Hospital, New York City. *Published by The Southworth Company, Troy, N. Y.,* 560 pp.

This, the first comprehensive work in the English language devoted exclusively to the roentgenology of the chest, is written conjointly by a clinician who generously recognizes the diagnostic value of the X-ray and by a roentgenologist who realizes the necessity of correlating clinical with roentgenologic facts for final diagnosis. Both are men of acknowledged ability, and they speak from experience with the vast clinical material afforded by Mt. Sinai Hospital.

Following a brief discussion of the normal lung, there are chapters on diseases of the pulmonary vessels, the trachea and bronchi. Then, commensurate with its importance, one hundred fifty pages are devoted to pulmonary tuberculosis, pneumonia, abscess, actinomycosis, echinococcus, syphilis, tumors and various other diseases of the lung, presented in detail. Five chapters are given to diseases of the pleura, and four to mediastinal lesions. The book ends with a presentation of the diseases and abnormalities of the chest wall.

Over four hundred roentgenograms illuminate the text. They are of adequate size and well reproduced in flat finish on excellent paper. The total absence of references to the literature, the large type and the unstilted language make the pages exceptionally interesting and easy to read.

It would not be difficult for the reviewer to indulge in captious criticism, point out minor imperfections, and perhaps even disagree with some of the authors' opinions. But that would be quite unfair, and it is the merest justice to say that the book will very satisfactorily fill a long felt want. To the rapidly increasing number of roentgenologic recruits, even to veterans who are not in constant drill, this volume will be an especial boon. Doctors Wessler and Jaches have contributed a lasting addition to roentgenologic literature.

OBJECTIONS TO THE USE OF THE "ONE LETHAL DOSE" METHOD IN MALIGNANCY[1]

By CHARLES H. NIMS, M.D., Hot Springs National Park, Arkansas

LOOK, if you please, at the medical lore of the last ten years. You see this statement: "The lethal dose should be given at one sitting," or: "If it is not practicable to give the entire dose at one sitting, it should be given in as short a time as possible."

These statements, with a ringing in of slight variations, have been repeated until it would seem that, convinced by reason of this very repetition, many have commenced to believe them.

It is the purpose of this paper to take issue with this dictum and to show from the writings and experience of the profession that the use of the term "one lethal dose" is unscientific and illogical.

There are advocates of two theories as to the effects of X-rays on cancer cells. The "Lethal Dose Group," if we may so call them, believe that the cell is killed by direct action of the ray, acting more efficiently, perhaps, when the cell is in active karyokinesis. The other group hold that the death of the cell is secondary, being brought about largely by the vascular changes induced by the treatment. These changes in the blood and blood vessels allow the cells to starve, as it were.

The writer believes that both elements enter into the death of the cell, but that the action on the supporting tissue and blood is of more importance than the effect on the cell itself.

Caspary, as quoted by Lewin,[2] has reported success in preventing cancer inoculations by previous raying of the site of the inoculation with small doses of X-rays. Lewin goes on to state: "All the experiences related confirm that in the fight against cancer we must stimulate the organism as a whole in addition to our local measures." His experiments indicate that the leukocytes and lymphocytes are active agents in this induced immunity.

The experiments of Murphy and Hussey[3] showed that heavy X-ray exposure for two hours on one-half of a tumor from a mouse made practically no difference in the number of takes after inoculation as compared with inoculations of the half of the tumor not thus treated. Furthermore, grafts from a non-radiated tumor placed on different areas of the same mouse failed to grow only when the area of inoculation had received previous radiation. The same results were not obtained in deep tissues.

These experiments demonstrate well that simple exposure of cancer cells to X-rays in accordance with a set of formulæ devised by Wintz and Seitz, or anyone else, is insufficient as a method for the cure of cancer.

Now, turning to those who depend on the effect of the rays on the supporting tissues, Ewing[4] states: "1. When a practitioner possessing a small amount of radium applies it to a rodent ulcer in repeated small doses over a period of weeks he usually observes the disappearance of the tumor and very often it never recurs. Meantime, the skin shows little reaction and the scar is small or absent. Exactly what he has done no one knows, but he has not killed any cancer cells. Sections taken at intervals through tissue so treated show hyperchromatism of nuclei and hydropic swelling of tumor cell bodies, followed by gradual atrophy of the cells. At the

[2]"Immunity to Cancer," C. Lewin, Medizinische Klinik, 1922, p. 983.

[3]J. B. Murphy and R. G. Hussey, Jour. Radiol., 1922, p. 19.

[4]James Ewing, Am. Jour. of Roentgenol., 1922, p. 331.

[1]Read before the Radiological Society of North America, at Detroit, December, 1922.

same time the surrounding tissues become active, leukocytes emigrate. lymphocytes and plasma cells appear, capillaries proliferate, and all these invade and replace the tumor mass. A slow, regressive process with degeneration of tumor cells, and a progressive process with exudation and proliferation of normal tissues are set going, and as a result of these processes the tumor is cured.

"2. When larger amounts of silver-filtered radium are used . . . the same course of events is observed. Some superficial tumor cells may suffer immediate necrosis, but tissue sections show that the bulk of the tumor is removed by a very rich exudate of lymphocytes and plasma cells, and by active growth of new capillaries which surround and compress much of the deeper parts and mechanically extrude the outer layers of the degenerating tumor cells. In many cases of this type I have failed to find many killed or necrotic cells, but have been able to trace all stages of the atrophy of degenerating tumor cells in the mass of reacting proliferating tissue. It is clear that the reaction of the tissues is an essential factor in the curative process. Under some circumstances, when this reaction fails, no amount of radiation succeeds in killing the tumor cells. I have seen recurrent rodent ulcer very heavily radiated, with necrotic stroma tissue, supporting well stained and apparently viable tumor cells. Every radiologist is familiar with these indolent reactionless cancerous ulcers which resist all efforts at cure and have to be excised or burned out.

. . . . . .

"The simple morphological interpretation of the changes reveals the highly important fact that in treating cancer by physical agents we are not merely killing cancer cells, in the sense of the physicist, nor extirpating it entirely, according to the surgeon's plan, but rather are calling upon Nature's forces to accomplish the cure. On this account we may assert that physical therapy, although still lacking some essential elements of an ideal method, is, to some extent, a rational therapy of cancer as far as we know the disease."

This statement is the clearest and most convincing that has appeared in the literature and if taken seriously would indicate not only that to try to give a lethal dose at one sitting would not be advisable, but, on the contrary, such a course would be going contrary to all of our knowledge as gained from the microscopic study of irradiated tissues. Such a course also would be going against common custom in the matter of dosage as practised not only by the more conservative followers of the divided dose method, but also, as shall later be shown, contrary to the common practice of those who advocate the "lethal dose" in their published writings.

The tissue changes as described are so in accord with the common experience of those employing radiation that they cannot fail to bear the imprint of truth. Many writers profess a belief in the so-called "lethal dose," but their writings contradict them. In most cases, their own technique belies their writings. Take Pfahler, for instance. In an article on radiotherapy in carcinoma of the breast, he says: "Theoretically it would be desirable to give a massive dose of radiation over the mammary region and the glandular areas leading therefrom at a single massive dose."

Now, what we desire to bring out is that theoretically giving such a massive dose would be the height of folly. To prove our contention we need only to read further in the same article the technique of the author himself to find that he thinks so too:

"Each application is the equivalent of two-thirds of an erythema dose. Each

of the areas is treated again during the second week so that the second radiation over each area is given a week from the first and each of the three areas receives two of these treatments within a period of two weeks. In other words, 1 1/3 erythema dose of deep radiation is given within a period of two weeks. If one adds to the direct action of the rays to these areas the secondary effect from the treatment through the other two areas, we must conclude that we are probably getting during this first two weeks apparently two erythema doses which is more radiation than could possibly be carried into the tissues by any other method. Some one may criticize this technique because a full erythema dose is not carried into each of these fields immediately, but by such process one would probably produce dermatitis and would certainly not be able to give more than half the amount of radiation within a period of a month. This technique has been developed after much experience, but will probably be modified in the near future."

The purpose of the writer is not to give a long drawn out, hair-splitting, ultra-scientific dissertation which begins at zero and ends at infinity, but it is to bring out a few salient points which have been evolved from the experience of the large number of X-ray workers, in this country especially. When these experiences and facts have been weighed and analyzed we try to shape our course for further advance in the treatment of malignant disease.

We shall not in this article dwell on the necessity of proper distance, proper screening, and proper use of various portals of entry to get the greatest proportion of rays into the area to be affected.

The article by Hirsch in the *New York Medical Journal* for August 16, 1922, is the best analysis that has come to our notice of the various factors that enter into the proper treatment of malignant disease. One paragraph will be of interest: "The technique of successful radiation of cancer demands: 1. A radiation of the proper quality and quantity. 2. The administration of the lethal dose of this radiation to all the cancer cells at the varying depths at which they exist. 3. The administration of the dose in such a way that (a), the local resistive power of the normal cells about the tumor is not depressed and (b), the general resistance of the whole organism is not appreciably lowered."

Factors that have not been mentioned which produce important limitations in the application of treatment are: radiation sickness, leukocytosis (following radiation), stimulation of growth by too small doses of X-ray, and necrosis from too much ray.

Concerning radiation sickness Narat[5] says: "The application of the roentgen rays to any considerable portion of the body causes a tremendous increase in the destructive metamorphosis of tissue. The effect under consideration is not that of a toxic dose, but that of a single therapeutic application. This calls for increased activity of the eliminative organs. The cases in which this increased destruction of the tissues is likely to produce a harmful effect are those in which there is already a disturbance in elimination of waste products, as in nephritis, congestion of the kidneys, cirrhotic kidneys or those in which the patient suffers fom toxemia of cancer, pernicious anemia, leukemia or similar diseases.

"As far as the unfavorable effect of irradiation on the different organs is concerned, there is practically no possibility of any specific after-treatment. The prophylaxis, consisting of a careful protection of the body from the roentgen rays with the exception of the area to be exposed, is the most important factor. It is sometimes extremely difficult to combat the roentgen toxemia.

[5]Joseph K. Narat, Jour. A. M. A., Nov. 11, 1922, p. 1681.

A careful observation of the patients after a roentgen ray treatment proves in many instances that this toxemia is not to be neglected, as it commonly occurs. Irreversible changes in the blood, a real roentgen cachexia, can cause a premature death. Though it is very vital to administer a lethal cancer dose at the first attack, a reckless irradiation is not justified and we would not do the patient a great favor in killing at the same time the cancer and its carrier."

It is well established that the leucocytosis which follows X-ray is an important factor in the cure of cancer. Overdose causes a more or less permanent reduction of the leukocytes.

On the other hand, it is well held and borne out by experience that too small doses of rays from tube or radium often tend to a stimulation.

Let us assume that this stimulation does occur that we may clear the way for a comprehensive view of the method of treatment that will give the best results after considering all of the factors involved.

Our treatment must avoid, first: radiation sickness and severe blood changes; second, too severe local reactions. It must produce the utmost reaction of the supporting tissues. It must be repeated as often as this maximum reaction can be produced.

You will note, if you will recall the dicta of Hirsch, that the conclusions here drawn are practically the same as those quoted from his able article. Still more remarkable is the fact that the technique, as developed empirically by the writer, is almost identical with that mentioned by Pfahler.

What, then, is the point at issue if men experienced in the use of X-ray develop a nearly uniform technique? Why worry if one group talks of the "one lethal dose," while the other talks of developing an immunity to cancer? Will not the difference be as immaterial as the difference between the Republican and Democratic parties?

I say, "No." While quinine has always been of value in malaria, it is only since the relation of the life cycle of the plasmodium to the disease has been thoroughly understood that really scientific therapy has been adopted.

Again, true progress can be made in treatment of cancer only when our treatment is based on a knowledge of pathology. It would certainly be fine if all there was to curing cancer was to consider the cell to be killed, its distance, its depth, its type, then take a slide-rule and set it at the point marked "cure." An X-ray machine set in accordance with the adjustment indicated would cure the case. This sounds extreme, but it is what some of our German friends would have us believe. It reminds us of some other German conclusions drawn as the result of pure mathematics.

The problem we are facing is the old one of assisting the human body in the fight against disease. The X-ray stimulates and assists the body in the fight against cancer. It does not kill the cancer.

Just a closing word as to the reason for this paper. It was not written that the experienced men should change their method, for, as has been shown, men who understand radiology and its limitations, develop their technique in accordance with said limitations. It was thought, however, that a paper of this sort might be of assistance to the beginner in radiology or the man who does but a moderate amount of work and who trusts to directions of the salesman of the machine and the gleanings from the literature for his information as to dosage and technique. Such an one might easily fall into serious error were he to follow the trend of thought as indicated in the literature of the last few years. To such an one I say: Do not take the writings of all the

experts too seriously. Follow their practice, not their theories.

To those who observe, cases like the following are familiar: A patient for whom a line of treatment, such as has been mentioned, has been prescribed, looks around a little and decides to go to the X-ray man across the street who gives massive doses. The so-called "massive dose artist" beneath his bold exterior being of a timid and law-avoiding disposition, gives a massive 2/3 erythema dose. The patient is assured that he has had sufficient treatment for six weeks. In six weeks this process is repeated. In ten weeks he returns to the divided massive dose man who finds that the treatment has been just sufficient to fan the flame and the patient is worse off than if no treatment had been given.

Again, a patient has been given sufficient radium to care for the local condition in carcinoma of the cervix. She is receiving the maximum of X-ray, front and back and laterally, that conditions permit. The ultimate outlook is unfavorable, but the patient is comfortable and happy, no odor, no pain, no discharge. Lacking assurance that the patient is cured, the husband sees in the daily papers that Dr. X, in a neighboring city, has secured one of a new type of X-ray machines giving a voltage that is phenomenal. (Incidentally, there are few such machines in the state, or country, as the case may be.) The husband notices that it is *hoped* that this machine will revolutionize the treatment of cancer. The wife, already saturated with treatment, is hurried to the city and given a twelve-hour treatment, heavily filtered, with the new wonderful machine. She is taken home deathly sick and for the few remaining weeks of her life suffers radiation sickness and cachexia—the immediate cause of death being too much ray.

To conclude: the cancer cell is not killed by "one lethal dose," but largely by the action on the supporting tissues. The proper dosage is one that stimulates the supporting tissues to the utmost, arouses only a mild negative reaction and decrease of leukocytes and avoids severe general radiation sickness. This dose should be repeated as often as conditions will permit for a period, varying in length in proportion to the size of the lesion to be eradicated.

ABSTRACT OF CURRENT LITERATURE

Keith, D. Y.: Tubercular Epiphysitis of the Greater Trochanter. *Amer. Jour. Roentgenol.*, 1922, ix, 549.

The author reports a case in a boy aged 12 years in which the clinical history and physical and roentgen-ray examinations pointed toward a neoplasm. There was a history of trauma, followed by a limp, and formation of a tumor in the soft structures in the neighborhood of the great trochanter, with marked enlargement of the superficial blood supply. The definite hypertrophy of superficial blood vessels is quite characteristic of sarcomata. The amount of bone destruction without bone production seen upon the roentgenogram would correspond to a bone tuberculosis, as according to Baetjer there is never any new bone produced in a tuberculous bone infection unless a mixed infection is introduced after operation, with a resulting sinus tract.

With the amount of bone destruction of the trochanteric epiphysis with extension to the diaphysis and increase in density of the adjacent soft structures and a definite tumor shadow, a diagnosis of infection should have been positive.

The roentgen-ray diagnosis was: (1) Neoplasm, destructive sarcoma. (2) Osteomyelitis, probably tuberculous. A definite diagnosis of sarcoma could not be made from the plate. The clinical and surgical diagnosis was degenerated sarcoma. The mass was incised, and pieces removed for pathological examination were stated to show tuberculosis but gave no evidence of neoplasm.

THE TREATMENT OF MALIGNANT DISEASE OF THE CERVIX WITH THE NEW HIGHER VOLTAGE, SHORTER WAVE LENGTH ROENTGEN RAYS, RADIUM, AND ELECTROTHERMIC COAGULATION[1]

By J. THOMPSON STEVENS, M.D., MONTCLAIR, N. J.

THE prognosis following surgical treatment of carcinomata of the cervix is not good. No less an authority than William Easterly Ashton says, "When the course of the disease is not interfered with by operative or palliative treatment, death invariably results in from one to two years, and in the majority of cases the fatal ending is reached in about eighteen months. At the present time hysterectomy offers but slight hope of a lasting cure. The vast majority of the cases operated upon have a local recurrence of the disease, and not more than 5 to 10 per cent are permanently cured. Probably even this is too large a proportion of the recoveries and we would be nearer the truth in estimating it at 5 per cent. Cancer of the cervix is a very frequent affection, nearly one-third of all cases of primary carcinomata occur in the uterus." Therefore I feel sure that you will agree with me when I say we are justified in our attempts to improve results by skilled use of the roentgen rays, radium, and electrothermic coagulation.

Because of the location of carcinoma of the cervix, treatment by the above-mentioned physical agents is not difficult or dangerous to the patient providing the operator understands his patient's requirements and that he has had sufficient training in the use of these agents to permit him to efficiently meet the indications.

To review briefly the plan of attack in each patient suffering with cervical malignancy: First, a very full history is obtained, a general examination, and a minute local examination is made in order to correctly determine the exact location of the disease and its extent. My examination, together with the results of the examination of the referring surgeon, are carefully studied, for without this knowledge any treatment will generally fail unless by accident the details are worked out correctly. The results of the surgeon's examination are obtained in writing on a special form which is furnished by my clinic. Then follows the measurement of the patient. She is measured from front to back, side to side, and from within the vagina, center of diseased area to front and diseased area to back. Then a drawing of the pelvis on plotting paper is made, the disease is drawn into the sketch, and the number of areas needed to produce a sufficient intensity of homogeneous X-rays in every tissue of the pelvis, including the diseased area, are determined. The actual technique of this procedure has been minutely discussed and published elsewhere by your essayist and will not be repeated here for obvious reasons. Briefly, however, using X-rays produced by at least 200,000 volts, heavily filtered, the number of ports of entry, the focus-skin distance, and time of exposure are plotted for each case according to the actual measurements of the case in hand plus measurement of the rays on the surface and in the depths with the iontoquantimeter.

Carcinomata on the surface of the body, if treated early and efficiently, can practically all be cured with the roentgen rays or radium. I need not go deeply into this fact since all of us are convinced that this is the best treatment for malignant growths so situated.

[1]Read before the Radiological Society of North America, San Francisco, June, 1923.

Cancer of the cervix can be made practically a superficial growth by the separation of the vaginal walls by means of a speculum. Edwin A. Merritt has described a technique for raying the cervix through the vagina. I consider this a very efficient method to bring up our local intensities, and make use of it in every case that I treat.

To hasten recovery, that is, to rapidly destroy the actual disease within the cervix, there are two very efficient agents, electrothermic coagulation and radium. I have every reason to believe that I will be challenged for mentioning radium as a locally destructive agent. However, if one will make some measurements with an electroscope he will find that with proper radium exposures the intensities of radium rays are sufficient only to destroy malignant disease within a radius of three centimeters of the site of application. I am sure some readers will agree with me. Electrothermic coagulation can be done upon the cervix directly by simply separating the vaginal walls with a speculum and by using a long-point electrode for reaching the disease through the speculum. This method of destroying the disease is most efficient; in fact, there is no agent that exceeds it, in my opinion. The lymphatics and blood vessels are sealed, thereby lessening the possibility of metastasis and preventing hemorrhage. It has the advantage over the actual cautery in that the heat is generated in the tissues. Deep penetration of destructive heat can be obtained by varying the size of the applicator, the larger or blunter points giving the deeper destruction. The actual cautery rapidly heats the tissues in immediate contact with the applicator to charring, while a very short distance from the site of actual application there is practically no heat; therefore, the disease is not completely destroyed by such treatment. However, the cautery does stop the bleeding that is so often a severe complication.

I have purposely omitted giving any definite technique thus far in the treatment of malignant cervix. None can be given because the technique must be built up for each case according to its requirements. However, I will cite in detail a few specific cases, with the technique used and results obtained. In judging the results one must remember that the old rule still holds; that is, the cases that recover are those who receive early, efficient treatment. The results are determined as a rule by the class into which a case falls: that is, (1) Cases which are clearly localized; (2) Cases which are doubtfully localized, the borderline cases; (3) Cases that are clearly inoperable, those presenting metastatic nodules at varying distances from the primary lesion; (4) Cases that are in the terminal stages of the disease, and (5) Cases that have developed recurrences. Nearly all of the cases in Class 1 can be cured by a skillful treatment with roentgen rays, radium, and coagulation, also many in Class 2 will recover. The results, while encouraging, in Class 3 will not be productive of many five-year cures, while Classes 4 and 5 will produce almost no permanent recoveries.

Some of the cases reported in this series were treated before any of us had machines for the production of the new higher voltage, shorter wave length roentgen rays, therefore, to be complete, I must here record the differences that we have noticed in my clinic during the past year, or since the installation of a modern apparatus for intensive deep therapy at maximum voltages. With the old lower voltage apparatus the treatments took many hours of actual raying, often fourteen or more hours. Many months passed before a case could be pronounced negative or in such condition that it was thought ad-

visable to give up treatment. The great nausea and vomiting usually present, together with the general depression, were enough to discourage the most aggressive patient. Whereas to-day the treatment is usually completed in from four to eight hours and many patients are negative in from one to two months following treatment. I still have nausea and vomiting and general depression to contend with, but I have made up my mind from experience, that they do not appear as frequently as in the "old" days; when present, they are not as great, and recovery is realized much quicker.

TABLE SHOWING STATISTICS IN THE TREATMENT OF CANCER OF CERVIX WITH RADIATIONS AND ELECTROTHERMIC COAGULATION

Year	1918	1919	1920	1921	1922	Total	Per cent recoveries
Localized or operable	1	1	2	4	6	14	100
Doubtfully localized or borderline	3	3	5	2	8	21	42 plus
Inoperable		3	2	6	15	26	11 plus
Hopeless	1		7	4	5	17	0
Recurrent			1		2	3	3 plus

All were proven cases except three of the localized group and one of the borderline group. Number of hopeless cases is small because some who presented themselves for treatment were refused.

Mrs. W. S., a patient of Drs. W. E. Doremus and V. Morse; age 40; sent for treatment Oct. 21, 1921.

The present illness was first noticed nine months ago and began with a watery vaginal discharge, gradually increasing in amount and thickness, became irritating, and a foul odor developed. Then streaks of blood appeared, and July, 1921, there was a real hemorrhage which soon became practically continuous. There has been considerable loss in weight and strength.

Upon vaginal examination it was found that there was active disease of the cervix extending into the vaginal fornix. Microscopic examination showed that the disease was squamous-celled carcinoma. Considered inoperable because of secondary anemia and extent of involvement.

August 22, 1921, by abdominal section Dr. Doremus ligated the internal iliac, ovarian, and sacro-median arteries, and treated the cervix thoroughly with the Percy cautery.

Radiation therapy was then advised and was carried out as follows: Two anterior ports of entry, just above the symphysis pubis; two posterior, over lower lumbar regions; one over each group of gluteal muscles with the patient in Sims' position, and one directly onto the cervix through a speculum. The tube was so centered over each area that the central beam passed directly through the cervix. Factors for the external treatments were: 16 in. f. s. d., 5 ma., 134,000 volts, 6 mm. aluminum filter. For the internal roentgen treatment the factors were: 12 in. f. s. d., 5 ma., 120,000 volts, one-sixteenth inch of glass filter. Two thousand milligram hours radium exposure using 1.5 mm. brass filter and 1 mm. rubber secondary filter was allowed from within the cervical canal. This treatment was given from Oct. 21, 1921, to Oct. 28, 1921, and all except the radium treatment was repeated Nov. 11, 1921, Dec. 29, 1921, Jan. 30, 1922, and Feb. 20, 1922, five series in all. Feb. 6, 1922, examination showed that the extensions of the disease into the vaginal fornix had disappeared. The cervix, however, did not appear healthy and so the residual disease was destroyed by electrothermic coagulation. The slough separated and was followed in two months' time by the appearance of a healthy scar, i.e., patient was negative. Result: Patient's weight has risen from 118 lbs. to 155½ lbs. on Feb. 15, 1923. She is doing her own work, even the washings. Patient has been negative now for one year and two months.

Mrs. H. E., a patient of Dr. E. Z. Hawkes, age 41, referred for treatment March 2, 1923.

The present illness was first noticed in Sept., 1922, when an unexpected vaginal hemorrhage appeared. Three weeks later another hemorrhage appeared and from then on, any slight exertion, such as coughing, would produce bleeding from the vagina. From Nov. 1, 1922, to Dec. 5, 1922, bleeding was continuous. Dec. 5, 1922, Dr. Hawkes explored the pelvis by abdominal section and cauterized the cervix. He considered the case inoperable.

Examination showed a healthy appearing individual though slightly pale. The cervix gave a doughy sensation when palpated and bled upon the slightest touch. While separating the vaginal walls with the speculum the vagina overflowed with bright red blood.

Cervical growth had a cauliflower-like appearance. Pelvic measurements were: Transverse 24 cm., antero-posterior 20 cm., center of cervix to external abdominal wall 13 cm., cervix to sacrum 7 cm. Patient's weight, 152½, normal 150 lbs.

Treatment: four ports of entry for the external application of the roentgen rays, two over symphysis pubis, two areas posteriorly, and one onto the cervix through the vagina. Factors for external treatments were: 50 cm. f. s. d., 4 ma., 220,000 volts, 0.6 mm. cu. plus 1 mm. aluminum, plus ¼ inch sole leather filter. Factors for the cervical treatment were: 12 in. f. s. d., 4 ma., 120,000 volts, one-sixteenth inch glass filter. These treatments were begun March 2, 1923, and were completed the following day. Then the disease was thoroughly destroyed by means of electrothermic coagulation. Two thousand five hundred milligram hours radium exposure was allowed from within the cervix using 1.5 mm. brass and 2 mm. rubber filter.

Result: April 9, 1923, the patient was negative, weight 156½ lbs. However, all treatments except the radium and coagulation were repeated. No further treatment was given and patient was discharged May 1, 1923. June 1, 1923, she was still negative and apparently in the best of health.

Mrs. D. H., a patient of Dr. H. Straub, age 50, referred for treatment Jan. 18, 1923, weight 210 lbs.

The present illness was first noticed in Feb., 1922, when there was a severe, unexpected vaginal hemorrhage. Since this time there has been an increasing vaginal discharge with abnormal bleeding. About twelve weeks ago pain in the lower abdomen, especially to the left side, appeared. Four weeks ago Dr. Straub cauterized the cervix and pronounced the disease inoperable. Cauterization has failed to stop all of the discharge and bleeding. Microscopic examination showed spindle-celled carcinoma.

Examination shows a tremendously stout patient who is very pale. Only stump of cervix remains and bleeds profusely upon the slightest touch. Uterus the size of four months' pregnancy. Increased resistance and fixation in region of left broad ligament. Disease extends from cervix onto vaginal walls in all directions. Pelvic measurements: Antero-posterior, 26 cm.; transverse, 34 cm.; cervix to abdominal wall, 16 cm.; cervix to posterior pelvic wall, 10 cm. Weight, 191 lbs.

Treatment: From Jan. 18, 1923, to Jan. 20, 1923, patient received six roentgen treatments externally and one onto the cervix through the vagina, two ports of entry over symphysis, two posteriorly, and two laterally. Factors were exactly the same over each area as in last case just cited. Two extra exposures were made to make up for increased size of patient's pelvis. Radium treatment likewise was carried out as in the last case cited. Result: March 15, 1923, patient was found to be negative but because of her size plus complaints of night pains in the pelvis they were repeated May 18, 1923, direct exposures having been made upon the cervix March 8, 1923, and April 6, 1923. At this time I discovered while talking with the husband that he had unmistakable signs of tabes dorsalis. Upon inquiring into the matter I learned that he had had a 3+ Wassermann. Therefore I have advised that this patient be investigated and treated along these lines by her physician.

I feel sure that these three cases are sufficient to bring out the points that I wish to emphasize. In the first case, the patient was not negative until six months after treatment was begun; the second case was negative one month after treatment was begun, and the third case was negative two months after beginning treatment. The first case was treated by an improved technique using roentgen rays of universal voltage, radium, and coagulation; the second and third cases were treated with roentgen rays of maximum voltage, radium, and coagulation. Convalescence was completed in the second case in one-sixth the time required in the first case, the third case requiring one-third the time of the first case.

CONCLUSIONS

1. The new higher voltage, shorter wave length roentgen rays are a distinct step forward. Convalescence is brought about much more rapidly than is the case when rays of universal tension are used.

2. Roentgen rays produced by not less than 200,000 volts plus radium rays permit of a homogeneous radiation of a pelvis of greater dimensions than is possible with the older technique and apparatus.

3. Actual measurements of the case in hand, together with actual measurements of the rays used, with an iontoquantimeter are absolutely essential if uniformly satisfactory results are to be expected.

4. Electrothermic coagulation is one of our best agents to successfully destroy malignant disease.

5. If cases suffering with malignant disease of the cervix are treated efficiently with roentgen rays, radium, and electrothermic coagulation, while the disease is still localized or operable, I feel sure that there will be many more five-year cures than is possible by any other method or methods of treatment.

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ABSTRACT OF CURRENT LITERATURE

Jacobaeus, H. C.: Thoracoscopy and its Practical Importance, Especially in the Surgery of the Chest. *Iowa State Med. Soc. Jour.*, 1922, xii, 432.

Jacobaeus of Stockholm writes on the value of endoscopic examination of the pleural cavity by special instrument, the thoracoscope, which can be employed in every case of exudative pleurisy, which is subject to a thoracentesis. The interest in these cases centers around the use of pneumothorax and thoracoscopy for the local diagnosis of intrathoracic conditions. Brauer of Hamburg was the first to show that on X-ray examination, after drawing off the exudate and its replacement by air, more beautiful pictures of existing conditions can be obtained than when the exudate remains. Jacobaeus says that for the diagnosis and localization of pleural and lung tumors it is of great importance to make an X-ray examination before as well as after the induction of pneumothorax. By making an X-ray examination after the induction of pneumothorax valuable information is obtained which completes that already obtained by the X-ray examination made before the induction of pneumothorax. By thoracoscopic examination valuable information is obtained for the diagnosis and localization of pleural and lung tumors which successfully completes the result of X-ray examination.

Jacobaeus quotes several cases to show the use of combined X-ray examination and thoracoscopy. In one of these cases a man had suffered from stitch in the left side for which he came to hospital. On X-ray examination a very large tumor was found in the pleural cavity quite filling up the posterior part. After the establishment of pneumothorax X-ray examination enabled the tumor alone to be seen but not its connection with the lung. But on thoracoscopy it was seen that the lung was lying rather free from the tumor and only slightly attached to it on the anterior side. In this case the tumor was easily removed.

In other cases the combined examination shows that the tumor, being intrapulmonary, is either very difficult to operate on or quite inoperable.

STANDARDIZATION OF ROENTGEN OUTPUT[1]

By FRANK RIEBER, San Francisco

THE subject of deep roentgen therapy has been gradually separating itself into various types of endeavor, co-operating toward the common end of making more effective the therapeutic use of the roentgen ray.

In advance, the biologist and physicist are together determining the general effect of different types of radiation upon living tissue and establishing, if possible, physical definitions of some sort by which the radiation which produces a certain biologic effect may be recognized and defined.

Next in order comes the engineer, whose function it is to take the general requirements outlined by biological and physical research, and from them create a practical, workable machine for producing the desired effect. Co-operating with the engineer is the manufacturer who sees to it that the results of this preceding design work are generally available for use.

And finally comes the roentgenologist, to apply the results of this study, in the form in which they have been embodied and given to him as tools, to produce a certain effect upon his patient.

The intention of this paper is to treat the engineering phase of the standardization of roentgen output, or dosage. Since this subject has been so much discussed, and from so many different angles, a brief statement of the factors existing in the problem of measurement will probably be of help, before we turn our attention to any definite concrete suggestion for its solution.

The entire problem can be said to center about the X-ray tube. We are using this tube, in a sense, as a converter, putting in one kind of energy, and getting out another kind, much as, in the case of an incandescent lamp, we put in electrical energy, and get out light energy and heat energy.

In the case of the X-ray tube, we put in electrical energy, of a slightly different type, and we get out heat and light energy, this last likewise being of a different type.

Now we desire to use the light output from our converter to accomplish a certain effect. How shall we measure or define this output in order to get the best practical, workable system for repeating a standardized dosage?

In the case of the incandescent lamp, we have defined its operation as a converter in two different ways. We have either spoken of a candle power as a unit of measurement—meaning by this a definite quantity of output, or we have referred to the lamp as a 30, a 60, or a 90 watt lamp, referring now not to *output*, but to electrical input.

Likewise in the case of the X-ray tube, we define its operation either on the basis of what we put in, in the way of electricity, or what we get out in the way of roentgen rays.

The definition of input seemed for a while to be the simplest way of describing an X-ray dosage. For a long time, we have been specifying X-ray dosage as so many milliampere minutes at such and such a spark gap and at a definite distance from the target of the tube.

This is a rather complex definition. When we have gotten all through stating the X-ray dosage in these terms, the best we can say is that we have defined to a certain degree of approximation the quantity of X-ray energy which will be delivered from a tube to a surface at the distance we have specified.

This method of defining output, although not extremely convenient, would still be useful, provided only that dosage

[1]Paper read before the Radiological Society of North America, December, 1922.

could be repeated accurately by its use on the same machine, or on different machines.

Experiment, however, shows that this is not the case. Defining input as we do it in terms of milliamperes and spark gap, and also specifying the distance from the tube, may permit us to make errors of as high as 50 per cent in estimating the X-ray dosage.

Errors of this sort are scarcely permissible in engineering practice, and they are particularly undesirable here in the light of what the physicist and the biologist have recently found out about the requirements for control and distribution of radiation in the treatment of malignant disease at a depth within the body.

In order to determine the general nature and quantity of the X-ray output from any apparatus, it has been customary for the user to start out on a series of investigations of his own, whereby, with the apparatus running at a fairly constant setting, the length of time necessary to produce an "average erythema dose" at a given distance was determined by that particular machine.

In other words, the user was actually standardizing his apparatus in terms of that rather indefinite thing, an "erythema dose," and recording the input necessary to create this unit of output, for purposes of duplication and repetition of the dose.

This unit of skin dosage, while it was for a time the only thing available for practical use in roentgenology, was ridiculously unscientific and totally unsatisfactory. For one thing, no two men could agree perfectly on the exact condition or appearance of the skin resulting from an application of an "erythema dose," and for another thing, results make it seem highly probable that no two patients react in the same manner quantitatively, to the same identical dosage of X-ray energy.

In physical measurements, the physicist has customarily used an entirely different method of measurement, and one apparently susceptible of greater accuracy. This is the "ionization effect"—the conductivity produced in a gaseous medium by exposing it to X-rays.

Assuming that this apparatus gives us dependable measurement, and there seems ground for such a belief, the operation of various X-ray machines under various conditions has been compared with ionization measurements as a standard, and the discrepancy earlier referred to, and more than suspected from experiments with the "erythema dose unit," has been fairly well confirmed by a number of observers.

We are now in a position to define the problem presented in standardizing roentgen ray output from the engineering aspect, as follows:

1. The roentgen ray tube should be treated as a converter, and its *output* in useful rays may be determined—

a. *Indirectly,* by making measurements relative to the electrical *input,* and estimating from the same the probable *output.*

b. *Directly,* by measuring the *output* itself.

2. The choice between these two methods depends on—

a. The accuracy with which the final quantity of radiation may be determined.

b. Complexity and expense of the apparatus involved and its adaptability for general use.

3. The indirect method (measurements of the *input* and *estimation* of the *output*) is in use widely to-day, but has been determined to be highly inaccurate. If it is to be used, one of the following additional steps must be taken:

a. If the cause of inaccuracy can be determined as residing in the measurements of *input,* develop and provide ad-

ditional measurements or safeguards so that the reading of *input* may be made to mean something definite in the way of *output*.

b. If the cause of the inaccuracy can be determined as residing in the X-ray apparatus supplying current to the tube, so modify this apparatus that the discrepancy is reduced, enabling the present method of measuring *input* to give a satisfactorily accurate determination of *output*.

4. To determine the relative availability of the direct method of measurements, the following factors must be considered:

a. Can the beam of X-rays be used to produce a measurable effect on some indicating substance, which will correspond to the biologic intensity of the action of the ray?

b. Can this indication be made to operate an apparatus sufficiently dependable for general use?

c. Can the indication of this apparatus be made to apply directly to the problem in hand without the necessity of computations or corrections?

Having prepared the above outline, we can now take up the comparison, from the engineering standpoint, of the indirect and direct methods of measuring the roentgen ray.

Considering first the indirect method and its inaccuracies, which are now widely recognized, an investigation into the causes of these inaccuracies seems to be in order.

Moore, in a paper read before the American Roentgen Ray Society in Chicago in 1916, first commented on the discrepancy in output between two machines of the same apparent input. He used the photographic results produced by the beam of rays as an indication of the output, and found that a "conversion factor" must be applied to the customary reading of crest kilovoltage and tube milliamperage before we could predict the output of a machine by reading its input.

The problems of radiography did not greatly tax the spark gap and milliampere methods of estimating X-rays, on account of the great latitude present in the photographic plate itself. Errors of the magnitude ordinarily occurring in operating two different machines, after having once determined the conversion factor, could not be perceptible as differences in photographic results.

The problem of therapy, however, demands a far more precise reckoning of the output of the X-ray tube. In connection with this problem additional information on the discrepancies between outputs seems desirable.

From a theoretical consideration of what must happen when a transformer and rectifier deliver power to an X-ray tube, the writer some time ago predicted that one of the large causes of discrepancy lay in the fact that the input energy to an X-ray tube came in a series of pulses, each pulse of potential varying all the way from zero to the crest value and back again.

Under these conditions, if we know only the crest value and the milliamperage, we cannot define accurately the electrical input.

If, however, we could find out the crest value, the milliamperage, and a third factor which we may term wave form, it would be possible to more accurately define what we are putting into a tube, and therefore more accurately predict what would come out in the way of X-rays.

An instrument for determining crest values of potential, and disregarding surges or brief transient potentials, was devised as a first step toward obtaining a more accurate practical method of measuring tube input. The writer described this instrument more fully in a paper read before the Mid-Winter Session of the American Roentgen Ray Society in December, 1922. (See Fig. 1.)

By the use of this instrument, it was found possible to reduce the discrepan-

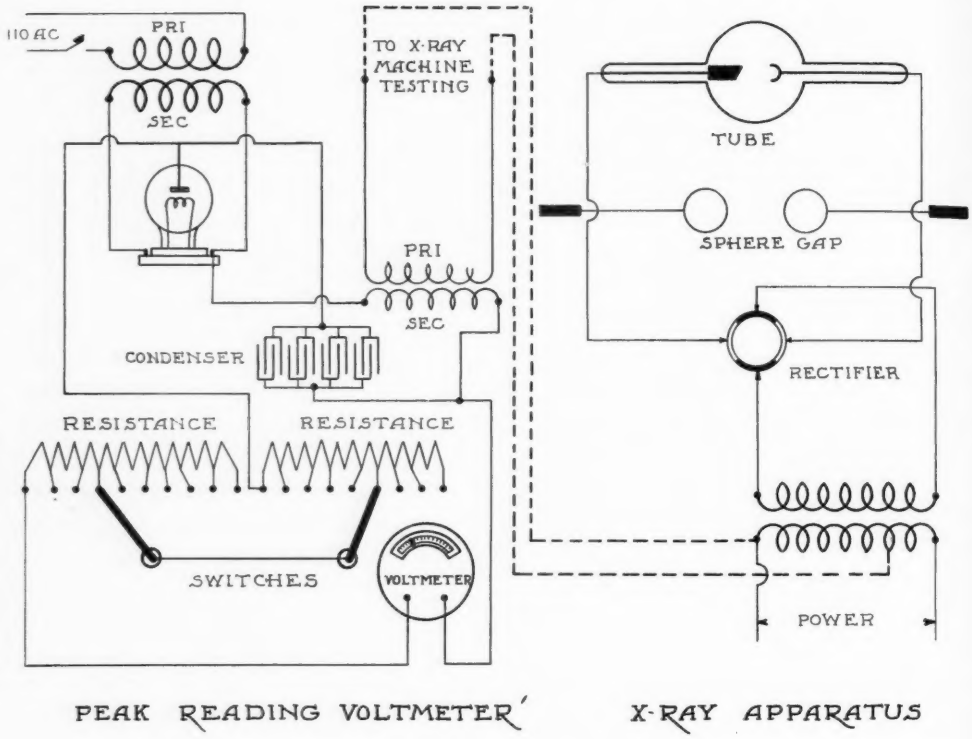

FIG. 1

Working circuit of "crest meter" developed by the writer in an attempt to improve methods of measuring electrical input to X-Ray tubes

cies previously experienced, but a number of other factors still existed which rendered this type of special meter still inadequate for the demands of practical use.

The chief facts developed by the use of this special meter were that the sphere gap is exceptionally sensitive to brief surges, which do not last long enough to produce any appreciable quantity of X-rays, but which may cause the sphere gap to indicate a potential *far higher* than that at which most of the X-rays are being produced.

These surges were found to be present in all circuits containing mechanical rectifiers of the ordinary type, and seem to be due to the sudden release of electrical energy in a circuit already under stress, when the rectifier approaches contact, and permits a spark to jump out and establish the circuit.

It seemed that if a source of high potential could be developed for exciting X-ray tubes used in therapy, which was free from fluctuations, or at least free from surges, it might then be possible to read the electrical input and feel reasonably certain that a correct estimate of the output was possible.

The most obvious method of constructing such a generating apparatus is to make it supply high voltage direct current without fluctuations or pulses of any sort. Such an apparatus has been devised by Hull, and numerous modifications of it have been used for laboratory work and in special installations.

From such information as the writer can gather about the performance of

this apparatus in continuous use, it would seem that it is necessary, in order to avoid damage to the tube, to operate at a lower potential than may be obtained with transformer and rectifier combination.

In addition to this, apparatus of this form would seem to entail somewhat greater cost, and to possess a few complexities that would render it less desirable for general use.

In an effort to devise some method for exciting tubes at a higher voltage, which would suppress surges and transient potentials, permitting more accurate measurements to be made, the writer devised an attachment adapted to be connected between an X-ray transformer of average power and the high voltage tube.

This attachment "boosts" the output of the X-ray machine to double the former potential value, and at the same time greatly reduces the surges present in the tube circuit.

Experience with the use of this attachment seems to show that a somewhat higher voltage may be sustained across the terminals of the X-ray tube for prolonged periods without damage, and, in addition to this, input and output measurements taken on such an apparatus seem to be much more consistent than where current is taken directly from the terminals of a rectifier and applied to the X-ray tube.

The circuit for this apparatus was described by the writer in a paper read before the Radiological Society of North America in June, 1922, and is reproduced here for reference. (See Fig. 2.)

A number of these installations have been placed in the hands of roentgenologists for continual use, and up to the present time seem to be giving rather consistent and dependable performance. As will be noted from the circuit, an auto transformer type of connection is employed, so that the apparatus is capable of delivering a very high milliamperage without a corresponding loss of potential at the tube terminals.

This brings with it the advantage that a number of tubes may be connected simultaneously to the same apparatus, without making any large change in adjustment to compensate for the drop of voltage with additional load.

In order to make the use of an apparatus with auto transformer connection safe at the high voltages, it is necessary to inclose the tube and high tension wiring completely, rendering it impossible to come in contact with them accidentally. This is rapidly becoming standard practice, however, and does not constitute a serious drawback to using the auto transformer type of circuit

As has been stated, when such a booster apparatus is employed to increase the potential of X-ray plant before applying it to the tube, it enables more consistent results to be obtained from the machine. That is to say, the output of rays from the tube can be brought to practically the same value, and repeated at will, by merely setting the apparatus to give the same input as determined by the sphere gap and milliammeter.

However, this equipment has not by any means solved the problem of measuring dosage in some universally applicable manner. The amount of X-ray energy generated by a tube running from a booster outfit at a certain spark gap and a certain milliamperage, is not only different from the amount of X-ray energy generated by a straight rectifier outfit under like conditions of measurement, but the amount of energy generated by one booster installation differs from the amount generated by another booster installation under like conditions of measurement.

This difference is due, as has been stated before, to differences in wave form.

All booster installations show a

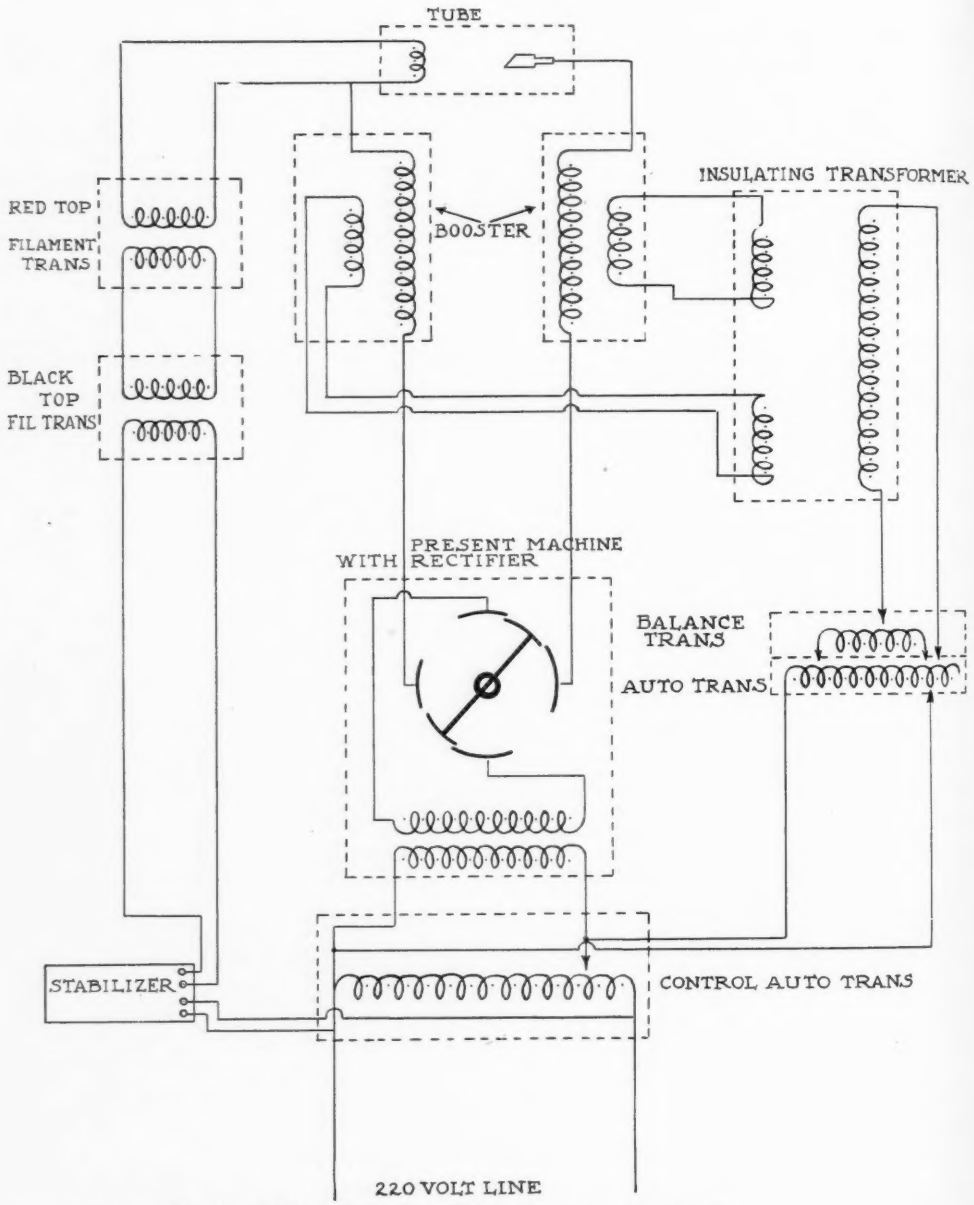

Fig. 2. Wiring Diagram of Deep Therapy Apparatus.

slightly higher milliamperage at the same indicated spark gap as measured on the sphere, in order to produce a beam of X-rays of intensity equivalent to that produced at the same spark gap by apparatus employing a rectifier and transformer alone.

This is due to the fact that, with the booster, a very small induced electromotive force is applied to the terminals of the tube during the portions of the wave preceding and following the main current impulse.

This slight potential is sufficient to cause an appreciable current to flow, thus rendering the milliamperage read-

ing higher. However, this is not to be construed as a disadvantage, since this additional milliamperage flows at a time when practically no voltage is applied to the tube, and consequently neither heats the tube appreciably nor produces appreciable X-rays.

It does make necessary, however, the adoption of a considerably larger working factor if the same dosage is to be given on a booster outfit as is given on an outfit employing rectifier and transformer only.

The discrepancies between one booster and another booster in the way of output at the same indicated input, are due to the fact that these equipments may be installed in one case on a cross arm rectifier using a relatively large arc of contact, and in another case on a disc type of rectifier using a very restricted arc of contact. The wave forms in these two cases can be so vastly different that the output of X-rays at the same indicated input may vary 20 or 30 per cent.

Possibly we have now plunged the entire subject of measuring the electrical input into such a state of delightful confusion that we can turn with positive relief to the possibility of measuring directly the X-ray output in some manner which will be adaptable to general use.

The writer has devised a dosimeter of this type (See Fig. 3), employing a small ionization chamber on the end of a flexible and highly insulated cable. This chamber is intended to be placed directly on the skin of the patient at the center of the port of entry, since at this position the skin dosage reaches its maximum, and the object of the apparatus is to measure the maximum total dosage applied to the skin during a treatment.

This cable connects with an instrument having a meter face with a circular scale divided into one hundred divisions. A hand is arranged to travel slowly around this scale, one division at a time. When the ionization chamber is exposed to X-rays, and a certain total quantity of these rays have impinged upon the chamber, the hand will move one division. If the X-ray apparatus is delivering energy at a rapid rate, the hand will move over this division in a short time. If it is operating at a slower rate, it will take a longer time. But the motion of the hand over one division indicates that a certain total dosage has been given.

By placing the chamber on the skin and making a continuous measurement, the following advantages are obtained:

1. The skin dosage is obtained directly by reading the meter indication, without the necessity for computing the square of the distance.

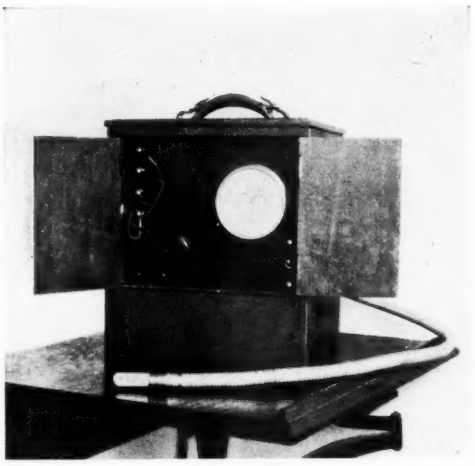

Fig. 3 Dosimeter.

2. The total dosage is recorded, no matter whether the apparatus is running with the milliamperage a little too high or a little too low.

3. If filters of a known thickness be used, and the skin of the patient be placed at a known distance from the target, a certain depth dosage will be given by the given skin dosage, and this depth dosage will not vary greatly even for considerable changes in spark gap on the apparatus during operation.

Experiments with these meters to date indicate that they possess a high order of sensitiveness, and that they are more than sufficiently dependable to justify reliance on the meter-reading alone for the determination of dosage.

As a practical point of convenience, dosage charts as commonly constructed show a maximum dosage delivered at the skin expressed as 100 per cent, and dosages delivered below the skin are expressed as lesser percentages.

Although there is some difference of opinion as to what constitutes a full safe skin dose, it seems advisable to determine, before calibrating these instruments, an average dose which may be safely given to the skin of the average patient. The meters may then be calibrated to read one hundred units at such time as this average safe dose has been given.

In order to compute depth dosage, it will then be merely necessary to deliver one hundred units at the skin and read from the chart the percentage which should be given at any depth with the tube distance, the opening and the voltage employed.

A standard of this sort—namely, one hundred units equal one full skin dose, is not *absolute*. That is, it cannot be tied in with any physical quantities so that it may be reproduced by others at a distance with reasonable accuracy. Neither can readings taken with this unit be compared directly with readings taken by other physical methods.

Therefore it is proposed that as soon as the desirable full skin dose is determined, an additional determination be made, showing the number of electrostatic units, as proposed by Duane, which enter into the full skin dose.

Likewise comparisons could be made showing the number of any other units entering into this same skin dose, and the instrument could be provided with a table giving conversion factors for changing measurements made by its use into measurements with other types of units—just as we have a table of conversion for inches into centimeters or yards into meters.

To assure the instrument retaining its accuracy, it is possible to equip each instrument with a small standard of radium, so arranged that it can be inserted into the instrument, and while in place, it should deliver a known quantity—say ten units—of radiation in a certain definite length of time.

The meters are provided with a fast and slow adjustment like a timepiece, so that, if tested with radium they run slow, the adjustment may be moved to restore the normal sensibility.

Summary

Estimating X-ray dosage output in terms of the milliampere and spark gap input to the tube is highly inaccurate and unsuited for the purposes of therapy.

Occasional measurements of the X-ray output by ionization methods are of assistance in enabling the operator to approximate dosage more closely, but such occasional measurements do not by any means define what is happening continually during the use of the machine.

A method of measuring dosage continually while it progresses, and adding the total effective value of dosage given to one patient on an easily visible scale, has been developed and is presented herewith.

Tests on this method to date indicate that it will be sufficiently reliable for general use, and that it will provide an interchangeable standard of measurement.

THE RADIATION TREATMENT OF HODGKIN'S DISEASE WITH PARTICULAR REFERENCE TO MEDIASTINAL INVOLVEMENT[1]

By ARTHUR U. DESJARDINS, M.D.

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IN 1832, Doctor Hodgkin reported several cases of the disease which has since borne his name, but this modest communication did not attract much attention at the time. In 1856, Wilks, unaware of Hodgkin's earlier work, reported a series of cases of similar nature, some of which had already been included among those cited by Hodgkin, but Wilks' description was much more detailed and complete, and attracted much more attention from the profession. In 1865, Wilks again added material to our knowledge of the disease by a very lucid exposition and analysis of the clinical features of this pathologic entity, which hitherto had gone practically unrecognized. From that date the literature of the subject rapidly increased, many physicians reporting cases, either typical in their manifestations, or exhibiting more or less unusual features.

Many more or less successful attempts to determine the etiology of the disease have been made. Among the successful attempts may be cited the well known fundamental work of Dorothy Reed, who definitely established the fact that the pathologic findings are fairly distinct, enabling the physician, by microscopic study of tissue from involved glands, to make a diagnosis in a large percentage of cases.

Among the less successful attempts were those of Bunting and Yates, who, having demonstrated in some cases the presence of a micro-organism, concluded that it was the etiologic factor. However, it was subsequently found that a similar organism could often be isolated in several allied conditions. In spite of extensive investigation the cause of the condition is still in the limbo of theoretical speculation.

The disease has thus far resisted all forms of treatment, and the path of its victims has been a more or less straight line to the grave. As the result of Billroth's report, in 1871, of the rather remarkable effect of arsenic in one case, this drug became widely used and found a place in nearly every medical textbook. Most of the authors agree that in early cases, when given in large doses over a prolonged period, arsenic does result in transient improvement. Surgical excision was tried, but it was soon discovered that, with the possible exception of a small number of early cases of the more chronic type, such intervention commonly leads to early recurrence and increased activity.

If we may judge by the lack of reports of cured patients, the disease remains as incurable as ever; and yet the outlook of the victim, while ultimately hopeless, is not immediately so desperate, because, in radiation treatment, we now have a means of relieving many patients for a more or less prolonged period and of postponing indefinitely the inevitable. In many cases the primary results are little short of miraculous. Furthermore, it may well be that, as the result of earlier recognition and of more prompt institution of treatment, a certain percentage of cases may be prevented from progressing further. At the present time too many patients, when they apply for treatment, have reached such a desperate stage of involvement as to cause very serious impairment of general health, with direct or indirect obstructive phenomena in

[1]Read before the Radiological Society of North America, December 4 to 8, 1922, Detroit, Michigan.

the respiratory, digestive or circulatory systems.

Certainly, if early diagnosis is of prime importance in reducing the mortality from cancer, it is just as essential in Hodgkin's disease, not to mention its blood relative, lymphosarcoma. Every agency used to educate the public to seek early advice in cancer, or to educate the profession to recognize the initial manifestations of cancer, should be extended to this class of diseases.

stantiate the infectious theory, prudence alone would seem to dictate at least the careful early study of every chronic adenopathy (not forgetting syphilis) for which an adequate cause cannot be found. Microscopic study of an excised gland by a competent pathologist will usually settle the diagnosis. However, all other causes of adenopathy having been excluded, even the inability to obtain a biopsy is no excuse for delaying treatment.

OUTLINE OF TREATMENT FIELDS IN HODGKIN'S DISEASE.

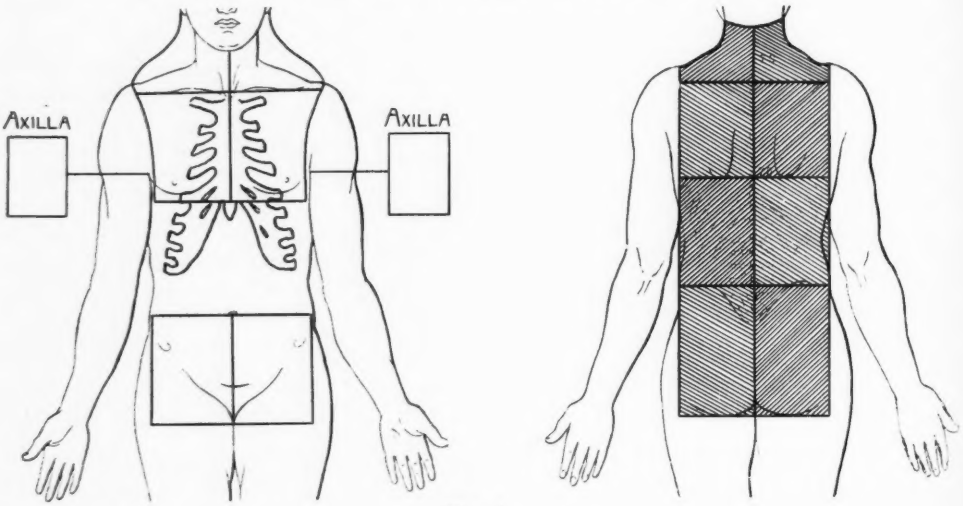

Fig. 1.

I do not wish to recapitulate our knowledge of the clinical features except, perhaps, to call attention to the fact that, in a large proportion of cases, the glands first demonstrably involved are those around the upper part of the neck and floor of the mouth. This naturally suggests that the etiologic factor, in such cases at least, may be in the nature of a chronic infectious process around the mouth and nasopharynx. It was undoubtedly this fact, among others, which led Bunting and Yates to advocate the early removal of all possible infectious foci. Whether or not this is a logical procedure, in view of the inability of many workers to sub-

To decry radiation therapy on the ground that it gives but palliative relief is not evidence of sound judgment, since all other methods of treatment thus far tried have failed to bring about anything like the results obtained by radiation. The profession owes it to the public and to itself to give a fair, wholehearted trial to this or any method that offers substantial chances of relief. That radiation offers such substantial chances and that such relief may often be maintained over a prolonged period cannot be denied by anyone at all familiar with the treatment as applied in this condition.

Treatment

The superficial gland groups (cervical, axillary, inguinal) may be treated with radium or with roentgen rays. Both agents are potent, though unequally, and both have advantages and disadvantages in certain cases, so that each case must be studied as an individual problem. The effect of radium is more rapid and the local reaction produced is more energetic and takes place within a shorter time. In cases with obstructive phenomena due to enormous hypertrophy of the cervical glands, for instance, it is desirable on the one hand to relieve obstruction as rapidly as possible, while, on the other, care must be taken lest too massive treatment at the start should produce edema of glottis and larynx which may be fatal. Also, because of the unit form in which radium is available and because of the mechanical difficulty in the application of separate radium units on such uneven and mobile surfaces as the neck, especially when distorted by adenopathic masses, it becomes impossible to deliver uniform dosage throughout the lymphatic structures in this region; this is also true in very large measure with relation to the axilla and groin. The action of roentgen rays is less intense at any given point, but much more evenly diffused throughout the area treated, and the reaction takes place over a somewhat longer period.

In general, and taking into account the foregoing, large glandular masses around the neck, axillæ, and groins are best treated with radium, because the effect is more rapid and relief more prompt. However, should radium not be available, roentgen rays will accomplish very nearly the same result, although the reduction of the glands will follow more slowly. Should radium be selected, it should be distributed in units of equal strength as evenly as possible over the entire region involved and well beyond its palpable limits. The dosage should be just short of the limit of skin tolerance. It is not wise to push the dosage beyond this, because, as is likely, treatment may have to be repeated several times during the course of the disease, and too strong an initial dose may interfere with later treatment, should it become necessary. In view of the multiplicity of glands, their unequal size and irregular distribution, the use of embedded radium units is not practical.

The common involvement of other gland groups, often demonstrable in the mediastinum and in the abdomen (paravertebral, omental, and biliary), may greatly complicate the problem of treatment, and the nearest approach to its solution lies in the correct employment of roentgen rays. To treat merely the demonstrated gland masses in the mediastinum, for example, is to invite later complications in the abdomen. The rational procedure would seem to consist in the thorough roentgenization of all the main lymphatic tracts from the very beginning. For some time all of our cases have been treated in this fashion and the early results, at least, are unquestionably better (Fig. 1). In cases in which no palpable glandular masses are present below the diaphragm, the lymphatic tracts are attacked from behind only, through fields along both sides of the vertebral column, and from the base of the skull to the pelvis. In dealing with mediastinal glandular tumefaction the treatment should be concentrated throughout this region from the front as well as from the back. If abdominal glandular hypertrophy can be disclosed palpably, frontal and rear attacks should be combined, although, in this event, the systemic reaction is likely to be more or less pronounced; one is sometimes forced to temporize by limiting the amount of treatment given at one time. In the female, unless the patient has reached, or is approaching, the meno-

pause, repeated treatment to the pelvis is unwise; this region should be avoided as much as possible.

Another point which should not be overlooked is that treatment should be discontinued as soon as the condition of the patient warrants. To prolong treatment without definite indications is to limit its subsequent effect in the event of recurrence.

The condition of the blood should not be lost sight of. A preliminary blood count should be the rule, and the count should be repeated after the first course of treatment, and should precede each subsequent course. Indeed, the state of the blood is one of the important indexes of the condition of the patient.

Dosage

The question of what constitutes the best dosage will not be answered until we have available reports covering the treatment of such cases with voltages of 150,000 to 200,000, and filtration "heavier" than 6 mm. of aluminium. In our cases I have used 135 kilovolts (sphere-gap reading) and filtration of 4.0 to 6.0 mm. of aluminium, the latter being given the preference in recent cases. Filtration through 0.5 mm. of copper has been tried a few times, but I have the impression that the results have not been better, if indeed as good. However, I hope soon to be in position to make a more thorough study of the relation of dosage (both filter and voltage) to the results obtained.

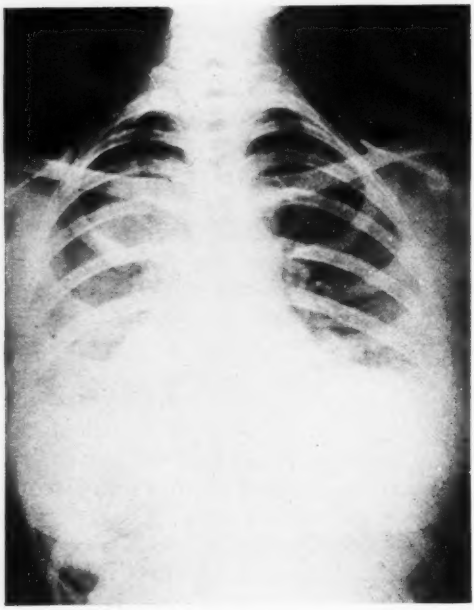

Fig. 2(A279213). Appearance of chest October 3, 1919.

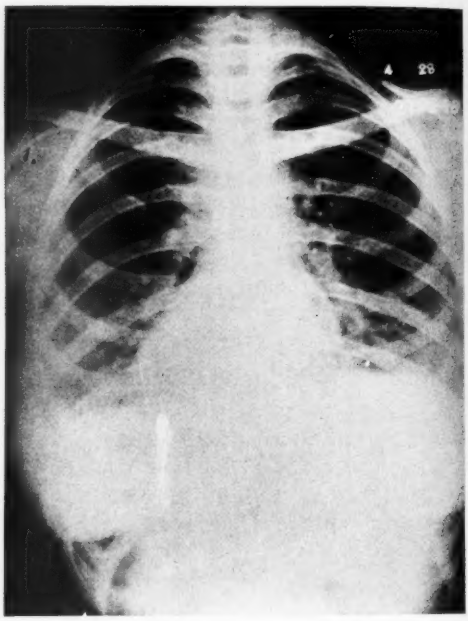

Fig. 3(A279213). Appearance of chest April 28, 1920.

Report of Cases

Case I (A279213), Miss T. B., aged 21 years, came to the Clinic July 9, 1919, because of masses under the right jaw and down the right side of the neck. The condition had first appeared two years before in the form of a small mass over the left portion of the sternum; this was painful and grew rapidly. In January, 1919, she had been oper-

ated on and a portion of ribs and sternum removed. Later another similar mass appeared lower down, which was excised three months later. One month afterward masses appeared on the left side of the neck; three months before her visit to the Clinic these were drained, and there has been constant drainage since.

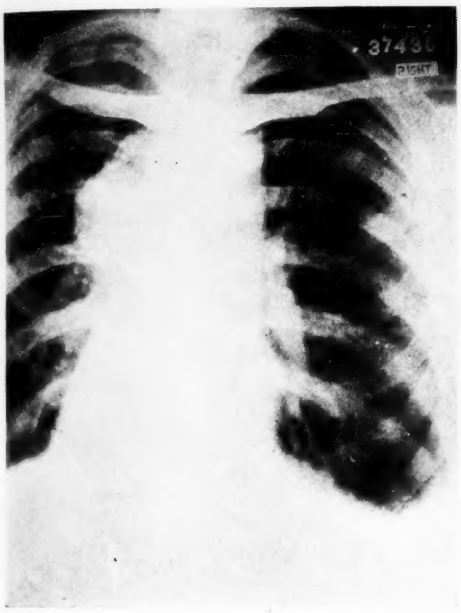

Fig. 4(A374303). Appearance of chest October 8, 1921.

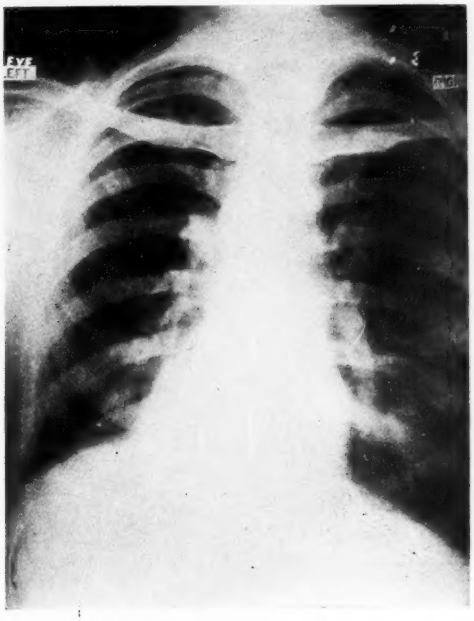

Fig. 5(A374303). Appearance of chest December 19, 1921.

On examination there was found general enlargement of all the glands around the jaw and on both sides of the neck varying in size from 1 cm. to 5 cm. The axillary glands also were enlarged. Over the upper left central portion of the sternum there was an area of deep ulceration 5 by 7 cm. in extent, with a thickened, white margin. Below the center of the sternum on the right side was another ulcerated area 5 cm. in diameter, with a similar margin. A roentgenologic examination of the thorax revealed the presence in the mediastinum of a large mass, which was thought to be glandular in character. Biopsy July 16, 1919 (gland from the neck), revealed the typical pathologic picture of Hodgkin's disease.

During the following week the patient was given a course of radium applications to the neck and to the ulcerated areas over the anterior thorax. This was repeated in August. When she returned to the Clinic October 2, 1919, she had gained 20 pounds, and was very much improved in every way. The glandular masses had greatly diminished in size, but a roentgenologic examination of the thorax revealed an increase in the mediastinal tumefaction discovered at the first examination (Fig. 2). October 9, 1919, roentgen-ray treatment was begun (none had been given before). The treatment was directed to the mediastinum from the front and from the back, to both axillary and inguinal regions, and to the paravertebral lymphatic tracts from behind. January, 1920, the patient's condition remained excellent, although her blood picture showed a slight increase of anemia; her mediastinal condition remained essentially unchanged. Her circumstances were such that she was not able to return as often as desirable. Treatment was repeated in January and again in May, June, July, August, and September, 1920. October 27, 1920, a roentgenologic examination of the thorax was negative (Fig. 3). All the superficial glands were hardly palpable, and the patient's general condition was essentially normal, the only deviations being a leukocyte count of 5,200 and a persistently

draining sinus at the site of the former areas of ulceration over the upper sternum (the other having healed). Another course of roentgen-ray treatment was given to the neck only, and radium was again applied to the sternal lesion, the ulcerated portion of which

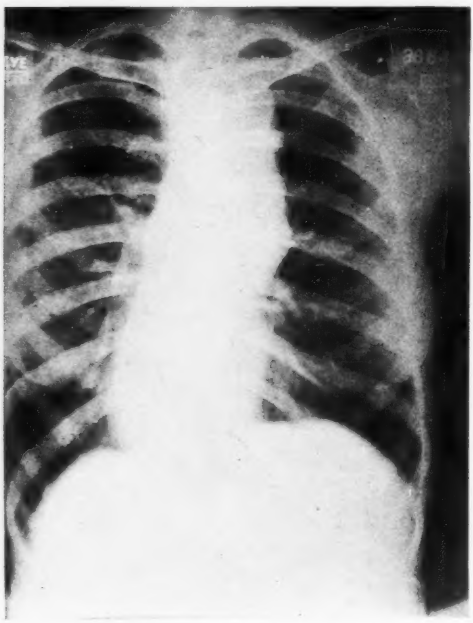

Fig. 6(A366493). Appearance of chest July 29, 1921.

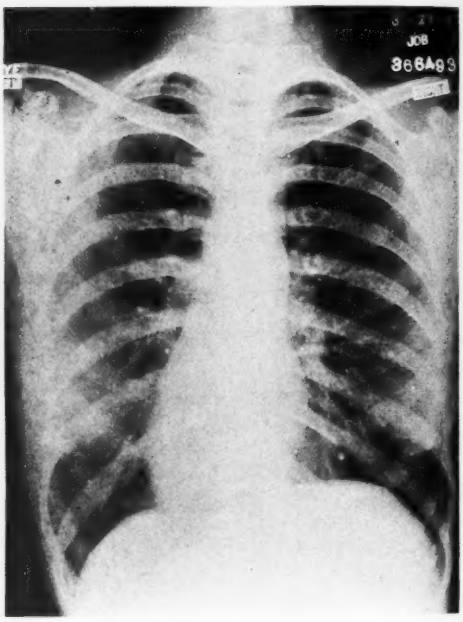

Fig. 7(A366493). Appearance of chest March 28, 1922.

had been steadily decreasing in size and now was a mere sinus from which exuded a little semipurulent discharge. August, 1921, the patient's general condition was excellent in every way. I have not seen her since.

Case 2 (A374303), Mr. A. B., aged 37 years, came to the Clinic October 7, 1921, complaining of "trouble in his chest." He had had influenza in January, and in March had been sick for two weeks with fever, cough, and concomitant pain in the chest. In May and June he had had a similar, although more severe attack, but had kept on working. He remained relatively well for a time, but in August the chest pain returned and he had had no respite. Morning cough and expectoration were present, the cough continuing through the day, but becoming worse in the afternoon, at which time he often had fever, and drenching night sweats were common. He had lost 25 to 30 pounds. He had not coughed up blood. He mentioned having slight shortness of breath, and moderate general pruritus.

On examination his body was found covered with scratch marks. There was bilateral enlargement of the cervical, supraclavicular, infraclavicular, axillary and intermammary glands (some of these were enormous), and increased mediastinal dullness. The veins around the upper anterior abdominal wall were engorged. Roentgenologic examination of the thorax disclosed a broadened mediastinal image from which a sessile rounded shadow projected into the upper left cavity (Fig. 4). A gland from the axilla removed for microscopic examination October 13, while partly broken down and necrotic, confirmed the clinical appearance of Hodgkin's disease.

Between October 15 and 21, 1921, the axillary and cervical regions were thoroughly treated with radium; at the same time the mediastinum was attacked by roentgen-ray "cross-fire" from front and back, and the paravertebral and inguinal glands also were treated. When the patient returned December 22, a roentgenologic examination of the thorax was negative (Fig. 5); the tumefaction had dis-

appeared. The superficial glands were smaller, but the reduction was uneven; the cervical glands had responded very well to the radium, but less so the axillary masses. The latter received another dose of radium, while the cervical, mediastinal, inguinal and paravertebral lymphatic tracts were again roentgenized. The pruritus, by the way, had almost entirely disappeared, and the patient had gained over 16 pounds. He was seen again in February, 1922. The appearance of his chest was still negative, and the superficial glands had diminished greatly, although some were still palpable about the neck and axillæ. Radium was again applied to the few remaining glands, and another final course of roentgen-ray treatment given. I have not heard from this patient for some time.

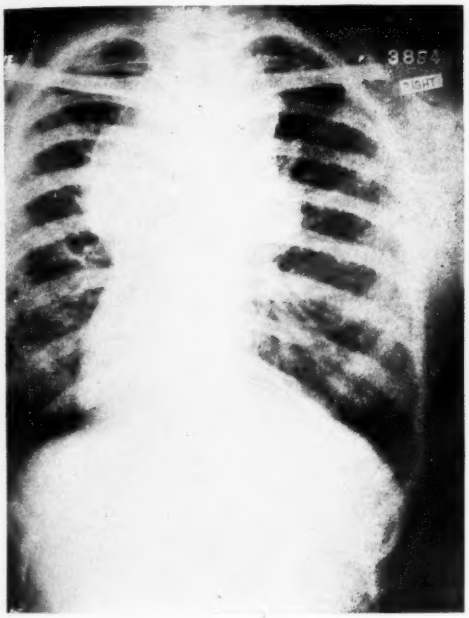

Fig. 8(A389452). Appearance of chest April 20, 1922.

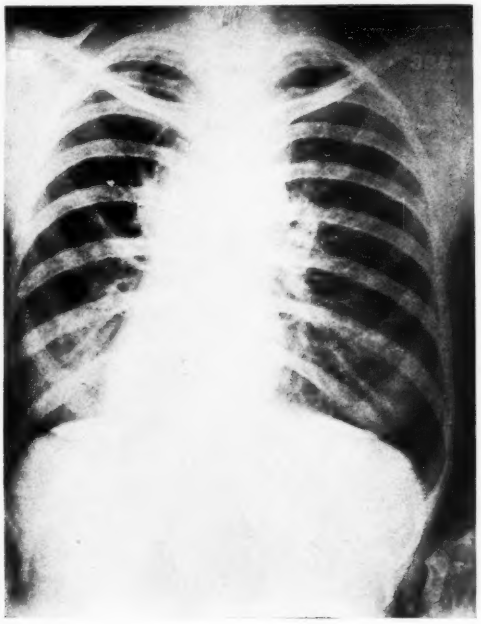

Fig. 9(A389452). Appearance of chest July 12, 1922.

Case 3 (A366493), Mrs. F. C., aged 27 years, came for consultation July 28, 1921, because of a glandular enlargement of the right side of the neck. Her tonsils had been removed in 1917. At the beginning of 1920, following the extraction of a right upper molar tooth, she had noticed at the root of the neck on the right side, an enlargement varying in size from time to time. She had lost strength since her last baby was born two years before. Otherwise, her general health had been quite good. For several months she had been annoyed by a general pruritus.

Examination disclosed the presence of enlarged, discrete glands in both anterior cervical triangles and one gland, approximately 2.5 by 1 cm. in the right posterior cervical triangle. Mediastinal dullness was distinctly increased, and a roentgenologic examination of the thorax revealed a right-sided tumefaction in the mediastinum extending from the first to the fourth ribs anteriorly (Fig. 6). A gland from the right supraclavicular region submitted to the pathologist brought a verdict of Hodgkin's disease.

The glandular enlargement being of secondary consequence in this case, no radium was used. The patient's first course of general roentgenization was given between August 6 and 10, 1921. She returned September 28, feeling very much better and having gained 5 pounds. The superficial glands and the mediastinal mass had almost disappeared. She was given a second course of roentgen-ray treatment between September 28 and 30. At her next visit, November 29, 1921, the chest was clinically and roentgenologically negative, and the superficial glands were no longer palpable.

The previous treatment had produced a considerable degree of anorexia, from which she had but recently recovered. At this time the treatment was limited to the mediastinal, axillary and inguinal regions.

March 28, 1922, the patient felt as well as she ever had, although inclined to tire easily. The condition of the chest was still negative and the accessible glands were quiescent (Fig. 7). She was seen again in July. For a month she had had a recrudescence of pruritus, at first limited to the chest, but later extending to arms and legs. Her general condition was excellent; there were no palpable glands, and nothing significant could be demonstrated in the mediastinum; however, in view of the pruritus, which is often synchronous with a return of activity, she was given another general course of treatment (the pelvis excluded). She has remained well and is still free from itching or other symptoms.

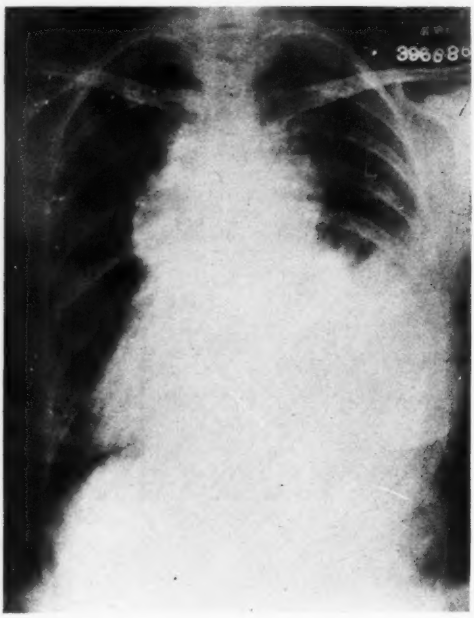

Fig. 10(A396686). Appearance of chest July 1, 1922.

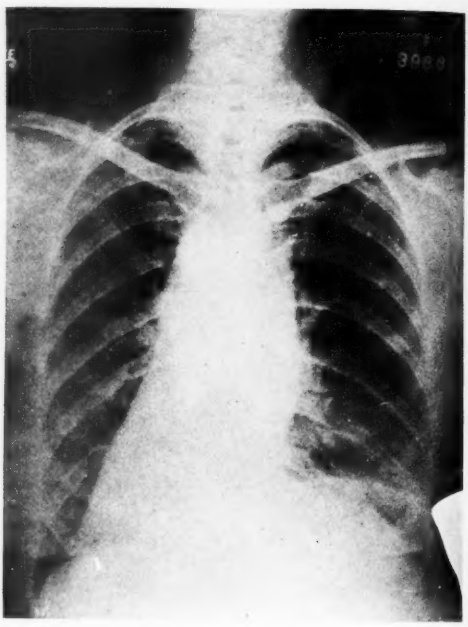

Fig. 11(A396686). Appearance of chest October 2, 1922.

Case 4 (A389452), Mrs. W. F. A., aged 38 years, was referred to the Clinic April 20, 1922, because of swelling of the neck and dyspnea. Following the birth of her last baby in June, 1921, she had noticed enlargement of the neck, and not long afterwards definite glands; these had remained enlarged although varying in size from time to time. From August, 1921, she had received several weekly courses of roentgen-ray treatment in another city. The dosage had been very small and limited to the neck. It accomplished little more than to check the growth of those particular glands. The patient gradually developed shortness of breath and, having caught a cold in January, 1922, all the symptoms became more pronounced, with swelling and puffiness of the face, and more recently of the hands, arms, and feet. At the time of examination she was quite dyspneic on the slightest exertion; she had a persistent and slightly productive cough, and a general pruritus, which had distressed her since the previous February. She had lost about 8 pounds in weight.

Examination revealed a small woman, with a puffy face, large neck and thin body. There was a brawny discoloration of the skin, more marked around the neck, probably due to previous roentgen-ray treatment. The dyspnea was only moderate with the patient sitting, but became much accentuated when she lay flat. Both supraclavicular regions were filled with puffy masses of coalesced glands together with many discrete nodules. Some of the glands in the right axilla were 3 by 2 cm., and the glands in both groins also were enlarged. Figure 8 shows the roentgenologic appearances of the mediastinum. A biopsy perform-

ed April 22, 1922, resulted in a diagnosis of Hodgkin's disease.

The first course of treatment was given April 26 to 28, and was limited to roentgen rays. When she returned for her second course, June 6, she was distinctly improved; her cough was almost gone and she had gained 3 pounds. July 11, the cough and the pruritus had entirely disappeared. She was stronger, and the superficial glands had diminished greatly (Fig. 9). On August 29, her improvement was still more apparent. When she returned in October (having been unable to come sooner as planned) she was not quite so well, and the mediastinal involvement had extended slightly, but this was stopped and her improvement now continues.

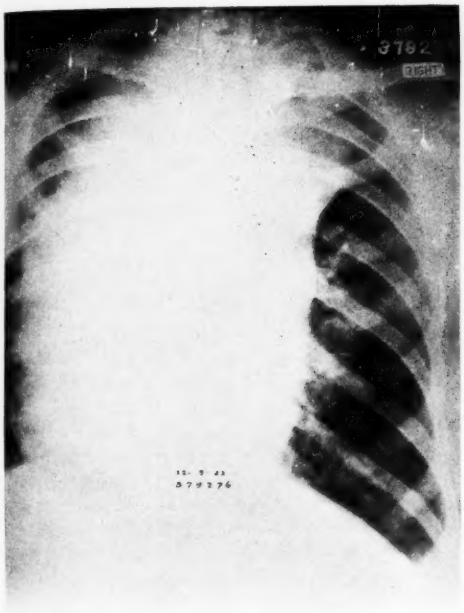

Fig. 12(A379276). Appearance of chest December 9, 1921.

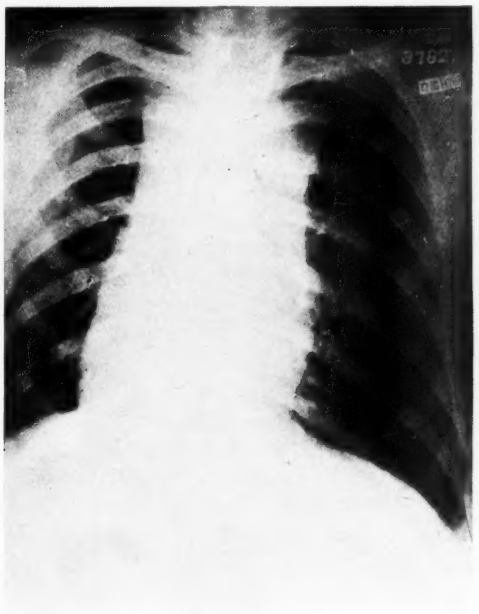

Fig. 13(A379276). Appearance of chest March 24, 1922.

Case 5 (A396686), Miss A. M. C., aged 45 years, came to the Clinic July 1, 1922. She had always been well and led a very active life until seven years before, when she began to have arthritis in various joints, for which an abscessed tooth was blamed and promptly punished, without benefit. She had had hay fever annually for thirty years. In the fall of 1920, she had an attack of asthma lasting a week, which recurred in February and in May, 1922. These attacks were accompanied by cough and fever. She had had night sweats, had lost strength and about 25 pounds in weight. She also had marked general pruritus.

On examination, there was found decided enlargement of the right cervical glands, but only slight enlargement on the left side. There was a wide area of mediastinal dullness and a flat note over the right lower pleural cavity. A roentgenogram revealed bilateral mediastinal tumefaction, with fluid at the right base to the level of the third rib anteriorly (Fig. 10). Biopsy, July 6, revealed Hodgkin's disease. July 8, a radium pack was applied to the glandular mass in the right cervical region. Between August 4 and 8 the left cervical, axillary, mediastinal and other regions were treated with roentgen rays. The patient returned to the Clinic October 3, stronger and much improved. The cough and dyspnea had practically disappeared. There was also pronounced improvement in the condition of the mediastinum, and the fluid had entirely vanished, leaving the basal pleura somewhat thickened (Fig. 11). There were no palpable glands, and the itching also had disappeared. The patient wrote recently that since her October treatment, she had gained 18 pounds, and felt like a new woman.

In view of the condition of these patients when first examined and treated

at the Clinic, it would be too much to expect such primary results, as are here shown, to be permanent. Nevertheless, they prove that radiation is a potent therapeutic agent and that very substantial benefit is obtained by the patient. The cases above cited are but a few taken from among a much larger number and I do not hesitate to say that such improvement may be expected in at least 80 per cent. However, such striking results do not follow treatment in every case. In a certain number the course of the disease may be checked for a short time and then proceed to a fatal termination, while in a few the treatment actually seems to hasten the process. What probably occurs in such cases is that, when treatment is instituted, the condition has reached a "critical point," and a very slight reaction on the part of the tissues seems to overtax the body and is followed by rapid decline. Case 6 is a fairly typical example of this type, although still more striking instances are occasionally met with.

Case 6 (A379276), Mr. E. H. N., aged 25 years, came to the Clinic December 9, 1921, because of enlarged glands of the neck and axillæ. He had first noticed glandular swelling on the right side of the neck in January, 1921. At the beginning of October, the right axillary glands began to swell and a month later enlargement in the left axilla appeared. Gradual loss of strength, pallor and loss of weight (11 pounds) had been evident for seven or eight months. Some shortness of breath had been noticed for six months, but cough had been present only one month. During the previous two weeks there had been slight improvement, and for three weeks pruritus of the legs.

The patient was a pale, slightly emaciated young man. There was moderate bilateral cervical and axillary adenopathy, and the area of cardiac dullness merged into an extensive area on both sides of the sternum where the percussion note was much impaired. The breath sounds were markedly diminished. A roentgenologic examination of the thorax revealed an enormous mediastinal tumefaction, filling very largely the left pleural cavity and at least a fourth of the right (Fig. 12). A biopsy December 14, 1921 (gland from neck), brought a report of Hodgkin's disease.

The first course of treatment was given the patient between December 16 and 22, 1921. When he returned January 24, 1922, he reported that the cervical and axillary glands had decreased in size soon after the treatment; the cough had almost entirely disappeared and the pruritus completely. He was stronger and had gained 5 pounds in weight. A roentgenogram showed that the mediastinal tumor had not been much influenced. A second course of treatment was begun January 24, but his white cell count having dropped to 2,800, treatment was discontinued, and he was sent home. He returned March 26, complaining of having had pain for two weeks in the left thigh and leg. The superficial glands had remained stationary, but the mediastinal tumor had been reduced to about half its initial size (Fig. 13). The leukocytes had returned to 6,200, but the lymphocytes were quite low (11 per cent). A third course of treatment was given March 27 and 28. When the patient returned May 8, the mediastinal mass had been reduced further, but in the right hypochondriac and umbilical regions was an irregular, hard, nodular mass, and on the scalp were two tumors. The abdominal mass was undoubtedly enlarged retroperitoneal glands. The patient was very weak, feverish, and without appetite. The disease was evidently progressing rapidly, and his general condition was such that it was deemed best to discontinue treatment.

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Thomson-Walker, Sir J.: Remarks on Pyelography. *Arch. of Radiol. and Electrother.*, 1923, xxvii, 334.

Thomson-Walker has used sodium bromide as the opaque fluid since April, 1920. He is a little doubtful in regard to its irritating properties, especially in solutions higher than 20 per cent, and has seen irritation of the renal pelvis and inflammation of the apices of the pyramids which he ascribed to the use of a solution of 30 per cent strength. It is undoubtedly very irritating to the bladder.

There are certain important points in the technique of pyelography:

1. The examination must be carried out without a general anesthetic. This enables the patient to indicate to the surgeon when the renal pelvis is full. Distention of the renal pelvis causes pain which will increase to a colic if the distention is continued.

2. Previous experience in catheterization of the ureters is necessary. Destruction of the kidney and even a fatal accident has resulted from inexperience and lack of care.

3. The fluid in the renal pelvis must be withdrawn before introducing the opaque solution. The injection of opaque fluid into a pool of retained urine gives a poor shadow.

4. The opaque catheters should be of moderate size, so as not completely to fill the ureteral lumen.

5. The catheter should be passed until it is arrested and then withdrawn one centimeter.

6. The patient lies on his back with the head low, the couch being inclined.

7. The radiologist should have the plates and tubes in position before the pelvis is filled and must be ready to make the exposure before any movement of the patient. This is of the utmost importance. One factor in the production of irritation of the renal pelvis and kidney by the opaque fluid is the length of time the solution remains inside the pelvis. Delay by the radiologist will therefore lead to some failures and it carries an element of danger.

Thomson-Walker says that the fully developed hydronephrosis may be diagnosed without pyelography. What is wanted is to try to recognize the early changes shown by the pyelography before destruction of the kidney tissues is advanced, and this can only be done by accuracy in reading the pyelographic plates.

The author discusses the essential points for the correct reading of a pyelographic plate; also the earliest changes observed in the development of a hydronephrosis.

In dealing with other uses of pyelography and ureterography he says that with the greatly improved technique of radiography a new difficulty has arisen for the urinary surgeon. Gall stones are now being demonstrated on the X-ray plate and shown in the renal area or near it. Pyelography will demonstrate the exact position of the renal pelvis and calices and their relation to a shadow in such a doubtful case. If the shadow does not lie over that of the renal pelvis or calices, we may conclude that it is extra-renal. With lateral radiography the gall-stone shadows lie well in front of the bodies of the vertebræ and are usually lower down, apart from the character of the shadows.

There are, therefore, two methods by which a gall-stone shadow may be distinguished from one thrown by a kidney calculus, viz., pyelography and lateral radiography.

The use of pyelography in the localization of a supposed stone shadow in the kidney, in the diagnosis of abdominal tumors, and in the diagnosis of renal growths, is referred to also.

RADIOTHERAPY OF MENORRHAGIAS OF THE MENOPAUSE AND OF UTERINE FIBROIDS[1]

By L. J. CARTER, M.D., BRANDON, MANITOBA

THE object in presenting this series of twenty-three case reports of uterine fibroids and menorrhagias of the menopause, treated by radiotherapy, is twofold:

In the first place, emphasis is given to the fact that deep X-ray therapy is good for 100 per cent value in the treatment of uterine fibroids whether associated with, or unaccompanied by, hemorrhage, and in the treatment of uterine hemorrhages of the menopause, whether dependent on fibroid conditions in the uterus, or occurring without demonstrable physical changes in the female pelvic organs.

In the second place, I wish to challenge the attention of the medical profession as a whole, and to deplore the general lack of knowledge that prevails with reference to the efficacy of deep X-ray therapy in the conditions above enumerated. In conversation with confreres in my own district, and in the study of text-book treatment of these conditions, there is evidenced a surprising lack of knowledge of, or an unwarranted failure to appreciate, the almost specific results which may be obtained by the X-ray as a remedial agent. The result is that many women remain unnecessary sufferers from a dangerous and debilitating condition, or are subjected to hazardous surgical procedures that are in most cases quite unwarranted.

A brief summary of the individual cases will indicate the history, physical findings, the line of treatment followed, and the results achieved, as well as call attention to some complicating conditions which did not interfere with the success obtained.

[1]Read before the Canadian Radiological Society.

CASE REPORTS

CASE 1, Mrs. A., age 48.

History: Continuous uterine hemorrhage for five months.

Physical examination: Negative.

Diagnosis: Menorrhagia of the menopause —no gross cause.

Treatment: Three series one month apart, beginning Nov., 1916. Each series being given through twelve ports of entry—six anterior and six posterior.

Results: No hemorrhage after the first period. Menopause established.

CASE 2. Mrs. M., age 50.

History: Profuse menstrual period, with malodor. Eight children, one miscarriage.

Physical examination: Uterus enlarged, boggy, movable. No tumors. No inflammation.

Diagnosis: Menorrhagia of menopause due to subinvolution.

Treatment: Four series, one month apart, beginning March, 1917, each series being given through eighteen ports of entry.

Results: No hemorrhage after first series.

CASE 3. Mrs. B., age 42.

History: Almost continuous uterine hemorrhage for one year. Eleven children, no miscarriages.

Physical examination: Large fibroid uterus.

Diagnosis: Menorrhagia of the menopause dependent upon fibroid changes in the uterus.

Treatment: One series through twelve ports of entry, Sept., 1917.

Results: Patient reported, Nov., 1917, that menorrhagia had ceased, and menstrual periods were occurring normally. No further report has been received.

CASE 4. Mrs. F., age 54.

History: Continuous menstrual period for four months. Four children, one miscarriage.

Physical examination: Cervix large, patulous and eroded. Uterus slightly enlarged. Hemorrhage not coming from cervix.

Diagnosis: Menorrhagia of menopause, complicated by slight subinvolution and endocervicitis.
Treatment: Four series, each through twelve ports, beginning March, 1918.
Results: No hemorrhage after first series, menopause established.

CASE 5. Mrs. L., age 50.
History: Increased menstrual periods, in amount and frequency. Six children, no miscarriage.
Physical examination: Fibroid uterus three times normal size.
Diagnosis: Menorrhagia of menopause dependent upon fibroid changes in the uterus.
Treatment: Four series, each through sixteen ports, beginning August, 1918.
Results: No hemorrhage after first series. Uterus returned to normal size. Menopause established.

CASE 6. Mrs. G., age 48.
History: Pain and swelling in lower abdomen. No hemorrhage. Eight children, no miscarriages.
Physical examination: Large, round mass, palpable externally, is large fibroid uterus.
Diagnosis: Fibroid uterus.
Treatment: Three series, each through twelve ports, beginning March, 1919.
Results: Tumor greatly reduced at last series, no report since.

CASE 7. Mrs. W., age 47.
History: Continuous menstrual period for four weeks. Fifteen children, one miscarriage.
Physical examination: Uterus small and hard.
Diagnosis: Menorrhagia of menopause—no gross cause.
Treatment: Two series, each through twelve ports, beginning Sept., 1919.
Results: No hemorrhage after first series. Menopause established.

CASE 8. Mrs. S., age 45.
History: Continuous uterine hemorrhage for six months. One child, no miscarriage.
Physical examination: Normal uterus.
Diagnosis: Menorrhagia of menopause—no gross cause.
Treatment: Three series, each through sixteen ports, beginning January, 1919.
Results: No hemorrhage after first series. Menopause established.

CASE 9. Mrs. W., age 42.
History: Continuous uterine hemorrhage for three months.
Physical examination: Large fibroid uterus.
Diagnosis: Menorrhagia of menopause, due to fibroid changes in uterus.
Treatment: Four series, each through twelve ports, beginning January, 1919.
Results: No hemorrhage after first series. Menopause established. Uterus reduced to less than normal size.

CASE 10. Mrs. C., age 46.
History: Menorrhagia.
Physical examination: Normal uterus.
Diagnosis: Menorrhagia of menopause—no gross cause.
Treatment: One series only, through twelve ports, June, 1919.
Results: Hemorrhage ceased. Menopause established.

CASE 11. Miss W., age 44.
History: Stomach trouble, weakness, no pelvic symptoms.
Physical examination: Fibroid uterus large as three months' pregnancy.
Diagnosis: Fibroid uterus.
Treatment: Six series, beginning Nov., 1919. The first two series were given through only four anterior ports of entry, the ovarian regions being carefully avoided. There was no change in the size of the tumor. The last four series were given through twelve ports of entry—six anterior and six posterior—no attempt being made to avoid the ovaries. After this change in technique the tumor gradually receded. Following the sixth series there was pronounced systemic reaction, with marked weakness, stomach upset, general pains. This continued for three months, at the end of which time the uterus had become normal in size, and the patient's health became normal again. Menopause was established.

CASE 12. Mrs. W., age 51.
History: Severe flooding at menstrual period, for six years.
Physical examination: Uterus normal.
Diagnosis: Menorrhagia of menopause—no gross cause.
Treatment: Two series, each through twelve ports of entry, beginning August, 1919.
Results: No hemorrhage after first series. Menopause established.

CASE 13. Mrs. W., age 47.
History: Uterine hemorrhage almost continuously for nine months. Twice married: by first husband, two children, no miscarriages; by second husband, no children, two miscarriages.

Physical examination: Uterus large and boggy, endometritis of Neisserian origin.

Diagnosis: Menorrhagia of menopause due to subinvolution and complicated with Neisserian endometritis.

Treatment: Three series, through twelve ports of entry, beginning Sept., 1919.

Results: No hemorrhage after first series. Menopause established. Uterus reduced to smaller than normal.

CASE 14. Mrs. W., age 41.

History: Continuous uterine hemorrhage for six weeks, with pain in lower abdomen. No children. Two miscarriages.

Physical examination: Uterus large. Hard, fibrous cervix. Large cystic left ovary.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in the uterus (chiefly cervical), and complicated by large cystic left ovary.

Treatment: Three series, each through twelve ports of entry, beginning October, 1919.

Results: No hemorrhage after first treatment. Menopause established. Uterus smaller than normal. Cystic ovary remains as before.

CASE 15. Mrs. T., age 42.

History: Hemophilia, previous severe attacks of epistaxis. Menstrual periods regular and normal, until sudden onset of severe uterine hemorrhage. Patient was sent to hospital and vaginal packing required. Two children, two miscarriages.

Physical examination: Uterus normal.

Diagnosis: Menorrhagia of menopause, no gross cause, possibly related to the hemophilia.

Treatment: Following a blood transfusion on January 5, 1920, three series were given, beginning January 12, each series through twelve ports of entry, patient being brought on stretcher for first treatment.

Results: No hemorrhage after first series. Menopause established.

CASE 16. Mrs. H., age 51.

History: Uterine hemorrhage for nine days. Pain in right lower abdomen and in lumbar region.

Physical examination: Uterus twice normal size, and hard.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in uterus.

Treatment: Three series, beginning January, 1920, each series through twelve ports of entry.

Results: No hemorrhage after first series. Uterus reduced to normal size. Menopause established.

CASE 17. Mrs. K., age 52.

History: Profuse, irregular menstrual periods for two years. Fifteen children, no miscarriages.

Physical examination: Large fibroid uterus.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in the uterus.

Treatment: Three series, beginning February, 1920, each series through twelve ports of entry.

Results: No hemorrhage after first series. Uterus reduced to normal size. Menopause established.

CASE 18. Mrs. S., age 50.

History: Constant uterine hemorrhage for three months, with pain in lower abdomen, thighs and legs and edema of both lower extremities. Shortness of breath, air hunger, loss of strength. Extreme anemia.

Physical examination: Large fibroid uterus incarcerated in the pelvis.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in the uterus, which was fixed in the pelvis and pressing on the blood vessels and nerves supplying the lower extremities.

Treatment: Following five blood transfusions, one series, through twelve ports, was given February 11, 1920. Hysterectomy was done on February 23d to provide immediate relief for the mechanical pressure on the blood vessels and nerves supplying the lower extremities.

Results: No hemorrhage after X-ray treatment.

CASE 19. Mrs. S., age 49.

History: For last five years menstrual periods have been lengthy, profuse, and irregular. There has been urinary frequency and marked weakness. Five children, one miscarriage.

Physical examination: Uterus retroverted, large and fixed by left-sided pelvic inflammatory mass.

Diagnosis: Prolonged menorrhagia of menopause secondary to subinvolution and complicated by left pelvic inflammation.

Treatment: Four series, beginning April, 1920, each series through twelve ports of entry.

Results: No hemorrhage after first series. Menopause at once completed, after five years' stormy onset. Left side pelvic inflammatory mass completely disappeared. Uterus returned to normal size. Retroversion was readily corrected, and position maintained by pessary.

CASE 20. Mrs. B., age 46.

History: Continuous uterine hemorrhage for seven weeks. Five children, one miscarriage.

Physical examination: Chronic endometritis. Fibroid uterus.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in uterus, and complicated by chronic endometritis.

Treatment: Curettage, followed by four series, beginning in September, 1920, each series through twelve ports of entry.

Results: No hemorrhage after first series. A normal menstrual period occurred ten days after the second series. No hemorrhage since. Uterus reduced to normal size. Menopause established.

CASE 21. Mrs. W., age 48.

History: Menstrual periods frequent and profuse for one year. Four children, one miscarriage.

Physical examination: A double cervix, uterine sounds entered two separate uterine cavities; there was an anteroposterior vaginal septum, dividing the vaginal vault into right and left halves.

Diagnosis: Menorrhagia of menopause, complicated by double uterus.

Treatment: Three series, commencing February, 1921, each series being given through twelve ports.

Results: No hemorrhage after first series. Menopause appears to be established.

CASE 22. Mrs. T., age 46.

History: Uterine hemorrhage lasting two weeks. Similar periodic flooding for past two years. No children, no miscarriages.

Physical examination: Soft, boggy, enlarged uterus, filling the whole pelvis.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in uterus.

Treatment: Eight series, beginning March, 1920, each series given through twelve ports of entry.

Results: No hemorrhage after first treatment, fibroid unusually resistant, but finally reduced to size of normal uterus. Menopause established.

CASE 23. Mrs. B., age 48.

History: Continuous uterine hemorrhage for six months. Three children, one miscarriage.

Physical examination: Uterus much enlarged and fibroid in character.

Diagnosis: Menorrhagia of menopause, due to fibroid changes in uterus.

Treatment: Three series, beginning March, 1921, each series being given through twelve ports of entry.

Results: Moderate hemorrhage two weeks after first series. No hemorrhage after second series. Third series just given.

CASE 24. Mr. B., age 60.

Analogous hemorrhage in the male. This case is presented because of the successful result obtained by treatment of an analogous condition in the male.

History: Passing of blood *per urethra.*

Physical examination by urethroscope: Hemorrhage from prostate.

Diagnosis: Hemorrhage due probably to prostatic congestion.

Treatment: Three series, each series consisting of one treatment over pubes, and one over perineum.

Result: No hemorrhage after first series.

SUMMARY

An analysis of the above cases, and a study of the results obtained reveals several outstanding features.

The most striking fact about the series is the uniformly successful results achieved. No case of hemorrhage refused to respond, and no fibroid uterus failed to shrink to normal, where the treatment was continued. Of the twenty-three cases reported, twenty-one suffered from uterine hemorrhage and two were uterine fibroids without hemorrhage. Of the twenty-one menorrhagias, ten were associated with fibroid changes in the uterus, and six showed no gross demonstrable pelvic lesion.

In estimating the efficacy of the result obtained, regard must be had to the severity of the cases. These were not simply cases of moderately increased menstrual flow at the menopause, but were hemorrhages of the most aggravated type, which had resisted other forms of treatment over long periods of time. In twelve cases there had been almost continuous menstrual flow for periods varying from one to twelve months. The list reads: ½ month, 1 month, 1½ months, 2, 3, 4, 5, 6, 9, and 12 months continuous hemorrhages. In two cases the disturbance had been pe-

riodic for five and six years. Some cases showed profound anemia; some required transfusion of blood. Many were brought to the treatment table on the stretcher, with vagina and cervix packed to temporarily control the hemorrhage. Yet all of the twenty-one menorrhagias responded promptly to the X-ray treatment. In eighteen cases, there was no hemorrhage after the first series of treatments. In one, there was a slight hemorrhage after the first series but none later. In one, there was no hemorrhage after the first series, but moderate hemorrhage after the second series, and none afterward. In one, which received but one series, the menstrual periods returned normally, and had so remained up to the last report. The average number of series given the menorrhagias was three.

Of uterine fibroids, two were unassociated with, while ten were productive of, hemorrhage. Of these twelve fibroids, one was operated upon because of other complications, one did not return for treatment after having received one series, one was greatly reduced in size after three series, but did not continue the treatment. The remaining nine were reduced to normal size. The time required averaged slightly more than four series, being somewhat longer than the average number of series given the menorrhagias. That the results are permanent is evidenced by the fact that many of the cases date back four or five years.

With such constant yielding of uterine hemorrhages and fibroids to the X-ray, it is not a matter of wonder that the radiotherapist should wax enthusiastic, and show even a degree of intolerance for those who do not comprehend, or will not see, the force of the statistics which he presents.

Another outstanding fact of the series is the variety of complicating conditions associated with uterine hemorrhages and fibroids, conditions which are usually regarded as contra-indications to X-ray treatment, but which did not in any way retard the good results in the cases, in this series, in which they occurred.

In one case a large cystic ovary complicated a bleeding fibroid uterus. When the hemorrhage was controlled and the uterus reduced to normal size, the cystic ovary remained unchanged. It still remains, after two years, unproductive of symptoms.

One case was complicated by the presence in the left side of the pelvis, of a large inflammatory mass, which held the uterus in irreducible retroversion. When the hemorrhage was controlled, and the uterus reduced to normal size, the mass was found to have disappeared, and the uterus was readily placed in normal position and held there with a support.

Four cases of hemorrhage were associated with subinvolution of the uterus. This had become reduced to normal size when the treatment had been completed.

Three cases were associated with endocervicitis, endometritis, and other uterine inflammatory changes. These conditions did not militate, however, against the success of the treatment.

One case was associated with the discovery of a double uterus, while one was in a patient who had shown evidence of hemophilia, yet both yielded equally good results to those obtained in the others of the series.

There have been no cases, in this series, of young women much below the menopause age. Yet one of the results in the series does suggest the possibility of so modifying the treatment as to make it applicable to menorrhagia in women during the child-bearing period, when it is not desirable to precipitate an artificial menopause. Mrs. B. (Case 3) received only one series, and reported three months afterward that

normal menstrual periods had been occurring regularly since the treatment. There is no question but that the X-ray can produce an artificial menopause at any age. There is also increasing evidence being accumulated by various radiotherapists, that a modified treatment, which will control uterine hemorrhage and not precipitate the menopause, is capable of being developed. When it comes to the question of the choice of treatment of a fibroid uterus in the child-bearing period, X-ray is certainly to be preferred to hysterectomy. Many cases are now on record of normal pregnancies occurring after the reduction of a large fibroid uterus by means of radiotherapy. In such cases care must be taken to shield the ovaries as much as possible from direct radiation.

The contra-indications for radiotherapy in uterine hemorrhages of the menopause and uterine fibroids really may be reduced to two. Surgery should be resorted to whenever the tumor is producing pressure symptoms which must be immediately relieved. The only other contra-indication is the possibility, through a mistaken diagnosis, of overlooking the presence of malignancy. The presence of uterine pelvic adhesions, or the co-existence of cystic or inflammatory pelvic conditions, does not contra-indicate X-ray treatment. Most of these conditions will be benefited by the radiotherapy. At any rate they will not interfere with the reduction of the fibroid and the control of hemorrhage.

The question of the degeneration of a uterine fibroid, treated or untreated, into malignancy, is one which may be dismissed at once. The change from fibroid tissue to carcinomatous tissue simply cannot occur. True, the two may co-exist in the same uterus, and it is only this possibility which gives any foundation for the objection to the use of the X-ray in uterine hemorrhages or fibroids. It is a question, not of degeneration, but of mistaken diagnosis. That the objection is not one of great moment is evident from the following considerations:

In the first place, the danger of error in diagnosis is small, if careful bimanual and speculum examination, and thorough general examination, are made.

In the second place, any error of diagnosis does not long postpone radical surgical treatment. Any uterine hemorrhage that does not respond to two series of X-ray treatments, is not due to fibroid changes, and should be further investigated.

In the third place, should the condition be one of malignancy, your X-ray treatment has been the very best preparation for surgical intervention. No malignant condition anywhere should be subjected to operation without previous thorough radiation of the tumor and all drainage areas, and until there has elapsed sufficient time for that treatment to have rendered quiescent the secondary invasions, in the endothelia of lymph and blood vessels, and in the lymph glands tributary to the involved area.

In the fourth place, while, theoretically, the possibility of overlooking malignancy is a possible objection to the use of X-ray, practically it does not occur. In the present series there has been no case of malignancy developing after treatment, and the writer has not found in the literature any mention of the subsequent development of cancer in any case that had been subjected to radiotherapy.

The standardized technique employed is as follows: Coolidge tube. Nine inch spark gap. Ten inches anode-skin distance. Five ma. ten minutes. Filter of 6 m.m. aluminum and sole leather. Twelve ports of entry, six anterior and six posterior. Usually two (not more than four) treatments per day. Intervals of one month. Three series to pro-

duce menopause; four or more to reduce fibroids.

The radiotherapist, who manipulates such a powerful agent as the X-ray therapeutically applied, should have some intelligent conception of its mode of action. That action is possibly threefold.

There is, no doubt, a direct action upon the fibroid tissues themselves. It is only one phase of the selective, destructive action of X-rays upon neoplastic cellular elements. The fibromyoma cells which constitute the uterine fibroid are really a form of neoplastic tissue, analogous, in a way, to the new-growths which we term malignant, and the unvarying success attending their reduction by radiotherapy is the first chapter in the story of the cure of neoplasms by X-ray.

A second factor is the well-demonstrated destructive effect of the X-ray upon the endothelial layers of the capillaries and small blood vessels. This leads to a thrombosis with resulting infarct of the tissue area supplied by the blood vessels involved.

But probably the most important result of the X-ray treatment is accomplished through its action upon the ovaries. This action is twofold: firstly, the effect upon the Graafian follicles, and, secondly, the effect upon the internal secretion of the ovary. There are some who assert that the X-ray, to control uterine hemorrhage and to reduce fibroids, must be sufficiently powerful to destroy the Graafian follicle. Others maintain that the results may be achieved without going to this extreme. Be that as it may, there is another factor which is possibly more potent, and that is the depressant effect of the X-ray upon the internal secretion of the ovary. Modern investigation of the causation of uterine hemorrhage and uterine fibroid lays much stress upon over-activity of the endocrine function of the ovary. Recent endocrine research has established the fact that the internal secretion of the ovaries, the thyroid, and the posterior portion of the pituitary body, are concerned in menstruation, the primary factor being the ovary, without which no menstruation can occur. Excessive internal secretion of any one, or any group, of these organs will precipitate a menorrhagia; the most potent disturber being the one which is chiefly concerned, the ovary. While there is abundant evidence that the X-ray acts as a powerful depressant to the endocrine function of the ovary, yet there is nothing in the effects produced by X-ray, as we use it in the conditions under discussion, which would suggest that it destroys that function. No writer has reported any symptoms following X-ray cure of uterine hemorrhages and fibroids, that at all resemble those produced by double oopherectomy. The ideal dosage of X-ray would be that which would depress the ovarian endocrine function just sufficiently to complete the menopause or reduce the fibroid. And the writer is of the opinion that such result can be obtained by a technique even less penetrating and less prolonged than the one followed in this series. In the promiscuous X-ray treatment of uterine hemorrhage and fibroid, which will follow the general recognition of its unfailing value, there will be danger that a too penetrating or too prolonged series of exposures may result in too great depression or even destruction of the endocrine function of the ovary, with all the disastrous results which followed complete oopherectomy, so popular among gynecologists a few years ago. And the writer would suggest that official X-ray organizations should publish a standardized technique, the adoption of which would prevent neophytes in radiotherapy from doing incalculable damage by overstepping the bounds of safety in too great depression or even destruction of the ovarian endocrine function.

EDITORIAL

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The following excerpt is taken from the report of the "Reference Committee on Sections and Section Work," of the American Medical Association, as delivered to the Council on Scientific Assembly at its recent meeting, held in San Francisco:

1. We especially endorse the recommendation that no changes be made in the number of sections of the Scientific Assembly. This opinion already has had the approval of the House of Delegates as expressed at the St. Louis Session.

2. We feel, however, that the Association should recognize the increasing importance of special medical activities, such as ariology, physiotherapy and occupational therapy; and to that end we wish to express our approval of that portion of the resolution offered by Dr. Van Zwalenburg which provides that, wherever possible, every section program should contain at least one paper on a subject pertaining to some other specialty of particular interest and importance to members of the section, and your committee makes such recommendation.

3. In view of the fact that laymen are attempting to practice radiology, we recommend that the American Medical Association recognize the science of radiology as an integral part of medicine and surgery.

4. We also wish to emphasize the recommendation that the Scientific Exhibit should be made available and utilized for demonstrating before the sections practical methods of diagnosis and treatment.

These recommendations were adopted.

It is apparent that roentgenology is becoming recognized as an integral part of medicine, due, principally, to the consistent conservatism and thoroughness of its workers, both diagnostic and therapeutic.

TECHNICIANS

The Radiological Society of North America stands foursquare for the encouragement and development of the American Registry of Radiological Technicians. The slow process of creating a sentiment for this Bureau has culminated in a definite policy which will be followed out in the years to come. The policy of recognition and encouragement of technicians is far-reaching in its effects, and has lifted the problem out of the field of controversy. At the present time the Radiological Society has a working bureau in which all technicians who are properly qualified may be registered for their mutual benefit and recognition by the organized roentgenologists.

The making of a technician is a slow and painful process. By far the majority of technicians are young women who aspire to make for themselves a career in which they may have a certain sense of independence and be above the ordinary level of labor. In certain laboratories the young men take up the work and fill a place to which a young woman would find it hard to adapt herself. The suitability of sex depends largely upon the character of the work, and partly upon the size of the place, but whoever undertakes preparation seriously will in the end receive an education which will be equal to that of any vocational course. Their success will depend largely upon their interest and aptitude.

Aside from personality, the most important preparation is a thorough knowledge of the fundamentals of physics and chemistry. This will include a serious study of the fundamentals with special attention to the fields of radiant energy and photo-chemistry. After the preparation in these fields of science, there must be a certain training in the art of handling patients. This requires more than tact; it requires a real insight into the psychology of human beings who are seeking for investigation of their troubles. No business office of any kind can teach this art. Some of it may be acquired in the training. Some of it should be obtained in preparation.

The training for the vocation may be divided into two main branches. As a rule a technician will need training in both diagnostic and therapeutic branches of the vocation. In the training the work may be disassociated into a practical study of the machines necessary for the work. This may be followed by a thorough drill in the practical side of the dark-room service. This may be followed by a repetition of standard technique until the novice is able to go through any of the routine procedure for the diagnostic service. The treatment room should not be merely the routine placing of patients, the watching or the setting of a time clock, and the opening and closing of the switches. To have a sympathetic interest in the patient and to operate the machines intelligently, something of superficial and deep therapy must be taught the technician. The therapeutic room should be the last course in the service. It should be a kind of post-graduate course. At first it appears simple, but with experience the magnitude and the importance of the task grow upon the technician.

Throughout the training, the care of the equipment must be emphasized until the technician has a thorough appreciation of the value and delicacy of roentgen equipment. It requires many months of training to produce the well-qualified technician for service in all parts of the roentgen laboratory. No matter if the individual should be trained for one branch of the laboratory service, she should have experience in all. Six months is not sufficient time for the preparation of a seasoned apprentice. This length of time may be sufficient to start the individual into training where considerable responsibility is delegated, yet before the Registry can accept such applicants, it must be demonstrated that they are master technicians and not apprentice technicians. The Bureau aims to register only those who are thoroughly prepared.

It is the general consensus of opinion that trained nurses seeking a special field of labor, bring to this vocation the best in the way of preparation. They have the experience in the handling of patients, they have developed a certain professional attitude; in other words, they have passed through a period of valuable training much as a soldier must, to receive the discipline necessary to make him a seasoned member of the army. It is not meant to imply that only trained nurses will succeed, but other things being equal, successful training is surer when given to trained nurses than to those selected hit and miss from the various strata of humanity.

We recognize that the morale of technicians will be strengthened by this recognition of their services. They are not unskilled laborers. Skilled labor can be made effective only when it receives the proper recognition for its services. Recognition of merit instills a spirit of hope and service. Recognition of the vocation tends to create a greater spirit of pride in the work. The association of technicians with others in the same vocation will permit a greater exchange of ideas and a better

standardization of the service which they will render. In other words, if the field for the technicians is raised to the plane of a vocation, the ethics of the vocation will be more thoroughly recognized, and more carefully followed by those who are participators in this vocation.

E. W. Rowe, M.D.

WHAT THE NEIGHBORS THINK

Radiotherapy in malignancy has, happily, long since become respectable. Within the memory of man she was a wayward child, the casual property of the beachcombers of the profession, as well as of its more ethical members, looked down upon from heights of superior virtue by her older and more staid therapeutic sister, Surgery. We, who love her, feel that she has not yet been accorded her proper place in the family circle, and we meet to deplore the fact. Unfortunately the rest of the family does not come to the meetings.

At the moment the most important thing in regard to radiotherapy seems to be not so much what it is capable of accomplishing, as what it is to be allowed to accomplish. Just now, the really vital opinion regarding it is not our own, but that of the surgeon, the internist, and the practitioner of general medicine. It is really immaterial whether we can eradicate 5 per cent or 35 per cent of pelvic malignancies, unless we can convince the surgeon that the latter figure is the correct one. It does not make any difference what we can do with early cancer if we are never to be allowed to see one.

The answer is, of course, education —of the profession. The plan is simple and goes back to the fundamentals of ethics, both professional and general. A scrupulous regard for the truth, recently recognized as a virtue inherent in all good advertising; moderation, both in word and deed; a niggardly spirit, when it comes to promises and a generous one in performance; and again truth.

Deep X-ray therapy is now going through one of those unfortunate phases which seem to be essential in the evolution of any new therapeutic measure, and opinion as to its real value and as to the technique of its employment is sharply and honestly divided. To-day one can obtain from the most interested and best informed, opinions, varying all the way from a flat statement that it is a grave disappointment and will be given up entirely within a few years, to the equally radical statement that it will supplant surgery altogether in the treatment of malignancy. The surgeon, particularly, comes to our mart with reluctant steps, and the more we claim, the more reluctant are his steps.

It has been said that a man's value to the community is in direct proportion to his ability to work in harmony with other men. Certainly the radiologist's value to the patient, or at least to the patient as a group, if not as an individual, is directly proportionate to his ability to work in harmony with the surgeon and the internist. And his work is, at the moment, under much more jealous scrutiny than that of the surgeon. No one thinks of discrediting the art of surgery on account of an occasional operative mortality. The blame, if blame there is, is laid at the door of the man, not of the art; of the individual and not of the instrument. Have we, perhaps, allowed the machine and its output of rays to be emphasized too much, and put too little stress on the experience and intelligence which must be behind it to insure worthy results?

If we talk of measured dosage, do we not perhaps err in putting too much emphasis on the idea of a "cancer dose," when we all know that cancers differ as

widely in reaction as do patients in disposition, and that any claim of absolute accuracy in dosage must cease when the beam of rays strikes the skin, since from that point, the unknowns obscure all formulæ? One hears some very caustic surgical comment on dosage charts, which seems not without merit.

Ought we to select our own cases for treatment or accept gratefully whatever is brought to us? Is the treatment of the patient with a hopeless post-operative recurrence, devoid equally—when he reaches the radiologist—of money and chances, apt to reflect credit on radiation therapy or bring benefit to the unfortunate patient?

No doubt the truth will prevail. If, however, we wish it to prevail in our day and generation it is essential that we comprehend more clearly the outside point of view, that we appreciate and try to correct the—frequently honest—skepticism of the surgeon, and that we try to present our case modestly and along lines on which most of us can agree. Certainly, and without putting a foot into debatable territory, we have a sound enough position in the treatment of malignancy that it need only be shown as it is.

C. D. Enfield, M.D.

THE ROCHESTER MEETING

Historical Note

The site of Rochester was first seen by white men when a party of United States surveyors in the Spring of 1854 had their attention attracted by the spray from the falls of a stream. Later this stream became known as the Zumbro River; its name is believed to be an anglicized form of the French, *Riviere des Embarras*. Within a few months several settlers were disputing priority of claims. Two of the claimants, George and Jonathan Head, maintained possession and established a town site. George Head named the town Rochester, because the falls of the river reminded him of those at Rochester, New York. He it was, also, who built the first dwelling, a log house near the present site of the Fire Department station on South Broadway.

From that time on Rochester grew slowly into a village, and its early history duplicated the simple annals of other western towns. It became the county seat of Olmsted County, and in 1883 had a population of about 3,500. In that year occurred an event which profoundly affected the destiny of the little city.

Late in the afternoon of Aug. 21, 1883, a tornado cut its way through the northern part of Rochester, killing twenty persons and injuring hundreds. In default of a hospital, one was improvised over a down town store-room. In charge of it was Dr. W. W. Mayo, a man of strong personality, a natural leader, and a physician whose professional reputation was already more than local. In urgent need of nurses, Dr. Mayo requested the aid of the Sisters of St. Francis, whose convent had been established by Mother Mary Alfred. Later, Mother Alfred offered to build a hospital in Rochester on condition that Dr. Mayo accept charge. It was so agreed, and after a period of negotiations construction of St. Mary's Hospital was begun. The hospital, which was of modest proportions, was opened for service in 1889.

At this time Dr. Mayo's sons, W. J. and C. H. Mayo, were entering the practice of medicine, and the new hospital gave an advantageous theater of action. This was the beginning of the Mayo Clinic.

Rochester of To-day

Situated in the southeastern part of the state, ninety miles from St. Paul and Minneapolis, in a region of scenic charm, on two important railway lines and numerous motor bus routes, the city

will be a convenient and attractive meeting place. With its towering skyline, miles of well paved and brilliantly lighted streets, beautiful residences, modern hotels, pleasant parks, myriad taxicabs and private automobiles, and its passing throngs, Rochester has a decidedly metropolitan aspect. A miniature city, with a population of 15,000, it has all the conveniences and few of the annoyances of a great metropolis.

Rochester Sky Line.

Accustomed for decades to entertaining medical visitors, Rochester welcomes physicians and willingly gives them its best. It will not be in the least dismayed by the many hundreds who will come to the Annual Meeting, and it will prepare to look after their comfort and pleasure.

Rochester is primarily a medical center, and the care of the sick is its essential industry. It is a city of clinics and hospitals and there is little to distract the attention and interest of the visiting doctor.

The Mayo Clinic

The Mayo Clinic, the nucleus of medical Rochester, has its central offices in a five-story brick and stone structure covering a quarter block at First St. and Second Ave., S. W. Convenient subways connect this building with the Kahler, Colonial, Curie and Damon hospitals. Here and in its subsidiary offices, the Clinic is occupied primarily with the examination of patients, who will number approximately 60,000 this year.

The professional staff comprises 260 physicians, including 160 Fellows in the Mayo Foundation, and 100 members of the permanent staff. In addition the Clinic has about 600 non-professional employees.

Hospitals

St. Mary's Hospital is situated in the western part of the city, one mile from

the Clinic. To the original building several additions have been made, the latest being the new surgical pavilion which was finished last year at a cost of $2,500,000. The hospital has a capacity of 600 beds.

The Mayo Clinic Building.

Other hospitals include the following:

Colonial, 230 beds.

Kahler, 200 beds.

Worrell, 200 beds; eye, ear, nose, throat and skin.

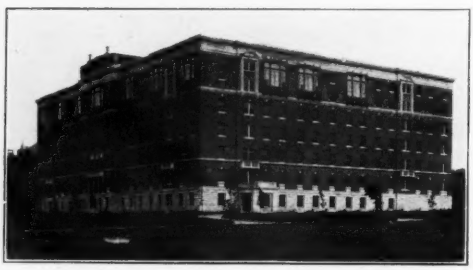
Damon, radium therapy.

Curie, X-ray therapy.

Samaritan, 120 beds, for convalescents.

Alfred, 50 beds, for convalescents.

Rochester State Hospital for Insane.



Surgical Pavilion, St. Mary's Hospital.

Transportation

Excellent train service is afforded by the Chicago Great Western and Chicago & Northwestern railways. Both roads carry special sleeping cars to Rochester from Chicago. The Chicago Great Western operates a special sleeper from Kansas City, and the Chicago & Northwestern one from Omaha. Passengers arriving in the early morning may occupy their berths until a reasonable hour for rising. Frequent day trains from Minneapolis and St. Paul are run by the Chicago Great Western. Principal schedules follow:

Lv. Chicago	Ar. Rochester
8:15 A. M. C. & N. W.	9:00 P. M.
8:01 P. M. C. & N. W.	7:15 A. M.
6:30 P. M. C. G. W.	6:50 A. M.
Lv. Omaha	
7:45 P. M. C. & N. W.	8:50 A. M.
Lv. Kansas City	
2.40 P. M. C. G. W.	6:50 A. M.

Full information regarding reduced fares was given in the October number of Radiology, but the following instructions may be repeated:

Tickets at the regular one-way fare for the going journey may be purchased Nov. 28 to Dec. 5 (not on other dates). Ask for a *certificate* (not a receipt) when buying going tickets. If no certificate can be obtained, ask for a receipt. Immediately on arriving in Rochester present this certificate (or receipt) at the registration office of the meeting, where it will be validated by Dr. Trostler, manager of transportation, and by the joint agent of the railroads. If 250 certificates are presented —and far more than this are expected —each certificate holder will be entitled to return at half fare over the route used in coming. Certain extra-fare trains of some roads will not honor such reduced fare tickets.

Arrangements are being made for special trains leaving Chicago Sunday evening, Dec. 2. It is hoped that all who plan to come via Chicago will avail themselves of these trains, as they will afford an opportunity for the members to get better acquainted. Dr. Trostler, 25 E. Washington St., Chicago, in-

vites correspondence concerning these trains.

Hotels

The hotels of Rochester are numerous and commodious and, although the anticipated large attendance at the meeting, together with the usual number of transients, will doubtless tax their capacity, they have agreed to reserve an ample number of rooms, and accommodations are assured for all who come to the meeting.

The Kahler Hotel.

Mr. Roy Watson, Secretary of the Committee on Hotels and Banquets, has already sent out application cards, and members are urged to fill out and return these cards in order to secure reservations.

Headquarters and Assembly Hall

To secure ample housing for the meeting, the First Methodist Church has been leased for the occasion. The church is only a block from the Clinic, and is quite near the principal hotels and the down town section. Its auditorium is capacious, with excellent acoustics. Headquarters, sessions and exhibits will all be in this building. The registration office will be open here at 9 o'clock Monday morning, Dec. 3, and daily thereafter until the meeting is concluded.

The Methodist Church where the Scientific Sessions and Exhibits are to be Held.

Exhibits

All exhibits, both scientific and commercial, will be displayed on the ground floor of the building. The rooms are large, well lighted and easy of access from the entrance and auditorium.

Commercial exhibitors can obtain complete information regarding space by corresponding with Dr. I. S. Trostler, 25 E. Washington St., Chicago.

Dr. C. G. Sutherland, Mayo Clinic, Rochester, is the chairman of the local committee in charge of scientific exhibits. Members who intend to contribute to the exhibition should write to Dr. Sutherland at once, giving number and size of films or plates to be shown. This should not be neglected as the time is close at hand.

Entertainment

The officers and counselors of the Society will be the guests of the President at luncheon, Wednesday, Dec. 5th.

During the meeting, entertainment for the ladies will be provided in the way of theater parties, afternoon teas and motor car trips.

Tuesday night, Dec. 4th, there will be a reception and get-together smoker for the members in the lobby of the Clinic. The officers are not acquainted with many of the members, and the purpose of this reception is to promote acquaintance and good fellowship.

Plans for the banquet at the Kahler Thursday night, Dec. 6th, are maturing and details will be announced in due time. Members are asked to indicate on the cards sent them by Mr. Watson whether they desire or not to attend the banquet. The banquet hall is of limited capacity, and seats will be allotted in the order of reservation until all are filled. Dr. W. J. Mayo will address the banqueters.

Mayo Park.

Calendar

Monday, Dec. 3rd

8 A. M. Clinics in the amphitheater, surgical pavilion, St, Mary's Hospital.

2:30 P. M. Executive session in assembly hall, Clinic building. This session will be continued in the evening after the usual dinner. (Officers desire that as many as possible of the counselors and members be present on Monday in order to dispose of business matters the first day and leave the committeemen free to attend the Scientific Sessions.)

Tuesday, Dec. 4th

8 A. M. Address of welcome at the Church, by Dr. Charles H. Mayo. Response by Dr. A. W. Crane.

8:30 A. M. and 2 P. M. Scientific sessions.

5:00 P. M. Clinic by Dr. A. U. Desjardins, sun parlor of Kahler Hotel.

8:00 P. M. Reception and get-together smoker, Clinic lobby.

Wednesday, Dec. 5th

8 A. M. Scientific session.

12:15 P. M. Luncheon to officers and counselors by the President.

2:00 P. M. Scientific sessions.

5:00 P. M. Clinic by Dr. H. H. Bowing, sun parlor, Kahler Hotel.

8:15 P. M. Staff meeting of Mayo Clinic in lobby of Clinic building. Program will be furnished by members of the staff and will deal as far as possible with radiologic problems.

Thursday, Dec. 6th

8 A. M. and 2 P. M. Scientific sessions.

5:00 P. M. Clinic by Dr. A. U. Desjardins, sun parlor, Kahler Hotel.

7:00 P. M. Annual banquet, main dining room, Kahler Hotel.

Friday, Dec. 7th

8 A. M. and 2 P. M. Scientific sessions.

5:00 P. M. Clinic by Dr. H. H. Bowing, sun parlor, Kahler Hotel.

Saturday, Dec. 8th

8 A. M. Clinics in the amphitheater, surgical pavilion, St. Mary's Hospital.

Preliminary Program

A. C. Ivy, B. H. Orndoff and A. Jacoby, Chicago, Ill.
"The Effect on Gastric Secretion of Exposure of the Abdominal, Thoracic and Limb Areas to X-ray."

Henry Schmitz, Chicago, Ill.
"The Clinical Significance and Treatment of Radiation Toxemia."

Bundy Allen, Iowa City, Ia.
"Nasal Accessory Sinuses in Infants and Children."

Max Kahn, Baltimore, Md.
"Primary Multiple Neoplasms Simultaneously Involving the Alimentary Tract. Case Report."

Burton J. Lee and Ralph E. Herendeen, New York City, N. Y.
"What can be Done for Primary Inoperable Carcinoma of the Breast?"

C. Winfield Perkins, New York City, N. Y.
"Roentgen Studies of Cardiac Disease in Children."

M. J. Sittenfield, New York City, N. Y.
To be announced.

Rollin H. Stevens, Detroit, Mich.
"Cold Facts in Cancer Therapy."

Wm. F. Braasch, Rochester, Minn.

"Fluoroscopy of the Kidney at the Operating Table."

E. H. Kessler, St. Louis, Mo.
"Our Mistakes."

Boyd S. Gardner, Rochester, Minn.
"The Place of the X-ray in Dental Diagnosis."

Douglas Quick, New York City, N. Y.
"Treatment of Carcinoma of the Mucosa of the Cheek."

Leon T. LeWald, New York City, N. Y.
"Thoracic Stomach: Differentiation from Eventration and Hernia of the Diaphragm."

P. P. Vinson, Rochester, Minn.
"Clinical Value of the X-ray in the Diagnosis and Treatment of Diseases of the Esophagus."

Lewis Gregory Cole, New York City, N. Y.
To be announced.

R. D. Carman, Rochester, Minn.
"Radiodiagnosis of Cholecystic Disease."

A. W. Adson, Rochester, Minn.
"Ventriculography."

C. D. Enfield, Louisville, Kentucky.
"Acromegaly Treated by X-ray; Report of a Case."

A. U. Desjardins, Rochester, Minn.
"Blood Count and Blood Pressure in High Voltage Therapy."

W. H. Wallace, Brooklyn, N. Y.
"Spondylitis; the Submerged Pathologic Entity in the Diagnosis of Obscure Conditions in the Abdomen."

Roy Kegerreis, Rochester, Minn.
To be announced.

E. W. Rowe, Lincoln, Nebr.
"A Compact X-ray Treatment Unit."

H. W. Myerding, Rochester, Minn.
"Roentgenologic Findings in Bone Tumors."

Amédée Granger, New Orleans, La.
"The Importance of the Granger Line in the Diagnosis of Disease of the Sphenoid Sinus, with Illustrative Cases."

P. M. Hickey, Ann Arbor, Mich.
"Undergraduate Instruction in Roentgenology."

J. Thompson Stevens, Montclair, N. J.
"Modern Methods in the Treatment of Cancer of the Breast."

R. B. Wilsey, Rochester, N. Y.
"The Measurement of Intensifying Factors of X-ray Intensifying Screens."

Wm. Engelbach, St. Louis, Mo.
"Osseous Development in Endocrine Disorders."

A. W. Crane, Kalamazoo, Mich.
"A Reconsideration of the Depth Dose in Roentgen Therapy."

L. R. Sante, St. Louis, Mo.
To be announced.

A. H. Logan, Rochester, Minn.
"Chronic Ulcerative Colitis; Its Clinical and Radiological Aspects."

Mary Elizabeth Hanks, Chicago, Ill.
"The Roentgen Ray as a Gynecologic Remedy; a Clinical Estimate of 200 Cases."

W. A. Newman Dorland, Chicago, Ill.
"Obstetric Roentgenography."

Gordon B. New, Rochester, Minn.
To be announced.

Alfred J. Mitchell, Chicago, Ill.
"Roentgenology from the Standpoint of Industrial Surgery."

Irving F. Stein and Robert A. Arens, Chicago, Ill.
"Interpretation of Roentgenograms in the First Half of Pregnancy."

Edward L. Jenkinson, Chicago, Ill.
"Roentgen Therapy of Breast Carcinoma."

A. W. George, Boston, Mass.
"The Vertebræ—Observations on the Changes Incident to Injury and Disease."

Sherwood Moore, St. Louis, Mo.
"The Roentgenology of the Fifth Lumbar Vertebra, in Some of Its Aspects."

Otto Glasser, New York City, N. Y.
"The Seemann Spectrograph."

W. E. Hart, Decatur, Illinois.
"Dilatation of the Stomach."

Albert Soiland and Wm. E. Costolow, Los Angeles, Calif.
"Short Wave X-rays in Other than Deep Conditions."

Chas. G. Sutherland, Rochester, Minn.
"A Radiological Study of Soft Tissue Tumors."

Lester Levyn, Buffalo, N. Y.
"Madelung's Deformity."

O. W. McMichael, Chicago, Ill.
"Artificial Pneumothorax."

Wm. L. Clark and Eugene C. Asnis, Philadelphia, Pa.
"Clinical and Microscopical Evidence why Electrothermic Methods are Efficient in the Treatment of Malignant Disease."

Isador Pilot, Chicago, Ill.
"X-ray Studies of Fuso-Spirochete Pulmonary Infections."

R. G. Giles, Boston, Mass.
"Deep Radiotherapy in Benign Hypertrophy of the Prostate."

Frank S. Bissell, Minneapolis, Minn.
"Certain Non-Tuberculous Chronic Lung

Lesions as Revealed in Roentgenograms —What Is Their Probable Significance?"

R. T. Wilson and J. B. Johnson, Temple, Texas.
"A Study of the Lymphatic System in Its Relation to High Voltage Therapy."

I. Seth Hirsch, New York City, N. Y.
"A Biographical Sketch of Roentgen."

Robert H. Millwee, Dallas, Texas.
To be announced.

Joseph C. Beck and Francis L. Lederer, Chicago, Ill.
"Pre- and Postoperative Interpretation of X-ray Films About the Head and Neck."

Edwin C. Ernst, St. Louis, Mo.
To be announced.

Robert I. Rizer, Minneapolis, Minn.
To be announced.

Robert S. Allison, Minneapolis, Minn.
To be announced.

H. J. Ravold, St. Joseph, Mo.
"Hemangioma with Calcification, Pre- and Postoperative X-ray Findings."

Clarence O. Simpson, St. Louis, Mo.
"A Reflex from the Trigeminal Branch of the Society."

Montford Morrison, Chicago, Ill.
"Differences in X-ray Measurements."

Leon J. Menville, New Orleans, La.
"Organized Medicine and Its Relation to Radiology."

W. W. Wasson, Denver, Colo.
"The Gross Pathology of the Chest."

L. J. Carter, Brandon, Manitoba.
"Pathology of the Right Upper Abdomen: Value of X-ray Signs as Checked by Operative Findings; Analysis of a Series of Cases."

W. I. Le Fevre, Cleveland, Ohio.
"Recent Roentgenographic Findings in Cases of Severe Gunshot Wounds Received During the World War."

H. H. Bowing, Rochester, Minn.
"Radium and Roentgen Therapy of Advanced Carcinoma of the Breast Prior to Amputation."

Frances A. Ford, Rochester, Minn.
To be announced.

ABSTRACT OF CURRENT LITERATURE

De Courmelles, F.: Indirect Radiotherapy; or Radiotherapy Controlled by Organic Correlations. *Amer. Jour. of Electrotherap. and Radiol.*, 1923, xli, 213.

De Courmelles for the past fifteen years has been applying radiotherapy to the ovaries as well as to the breasts in cases of inoperable breast cancer. In 1922 he reported six cases of notable improvement in cancer of the breast under combined radiotherapy of mamma and ovaries. Of these six cases, three were scirrhous cancer and these have been in excellent condition since 1919. To these eight more cases are now added which have reacted favorably in the same way, but since duration of results is the point of highest importance, the only fact now to be noted in regard to them is the acceptable respite obtained in the progress of the disease.

With regard to the physiological laws which control these organic correlations, there is no question as to the remote influence and interorganic currents generated or developed by the rays from a Crookes tube. The author points to the systemic effects of raying of the adrenals and of the spleen in support of the effects or the remote influence of irradiated organs. Roentgenization of the spleen provokes the formation of a soluble ferment, leucocytolysine, which dissolves the leukocytes of the blood and liberates the antibodies they contain and at the same time stimulates the production of new leukocytes by the bone marrow

The correlation of the breast and ovaries is well known and surgeons have availed themselves of the knowledge by the ablation of the ovaries in cases of breast cancer. In cases of hemorrhage following radiotherapy of a fibroma which has yielded to simple raying of the fibromatous uterus, raying of the ovaries brings about an earlier cessation of the hemorrhage by reason of the ovarian reinforcement. In mammary cancer direct raying of the ovaries effects what the Germans call a "dry castration," the influence of which on the mammary glands resembles that of a surgical ablation.

In De Courmelles' cases 30 or 40 Holzknecht units, repeated at three places in fifteen or twenty brief sittings, yielded the result of prolonged survival with greatly reduced tumors from which pain had totally disappeared.

De Courmelles says that in indirect radiotherapy at the bidding of organic correlations, the greater number of them yet to be discovered, has at least come into being. It is a new branch of the science and will surely be developed.

GENERAL INTEREST

The Association of American Medical Colleges requires for admission to and graduation from colleges holding membership in this association, 15 units of high school work and two years (60 semester hours) of college work.

The entire course of four years shall consist of not less than 3,600 hours, and shall be grouped in divisions and subdivided into subjects, each division to be allotted approximately the time, on a percentage basis, as shown in the following schedule:

1. Anatomy, including embryology and histology	14	-18½%
2. Physiology	4½	- 6 %
3. Biochemistry	3½	- 4½%
4. Pathology, bacteriology and immunology	10	-13 %
5. Pharmacology	4	- 5 %
6. Hygiene and sanitation	3	- 4 %
7. General medicine (neurology and psychiatry, pediatrics, dermatology and syphilis)	20	-26½%
8. General surgery (orthopedic surgery, urology, ophthalmology, oto-laryngology, roentgenology)	13	-17½%
9. Obstetrics and gynecology	4	- 5 %
	76	-100 %
Electives	24	- 0 %

MEMBERS OF ASSOCIATION

University of Alabama School of Medicine.
Stanford University School of Medicine.
University of California Medical School.
University of Colorado School of Medicine.
Yale University School of Medicine.
Georgetown University Medical School.
George Washington University School of Medicine.
Howard University School of Medicine.
Army Medical School.
Navy Medical School.
Emory University Medical Department.
University of Georgia College of Medicine.
Loyola University School of Medicine.

—*A. M. A. Jour., Aug. 18, 1923.*

Dr. Louis K. Poyntz, Radiologist to the Provincial Royal Jubilee and St. Joseph's Hospitals, at Victoria, British Columbia, has resigned and moved to Portland, Oregon. He is now on the teaching staff of the University of Oregon Medical College and is Radiologist to St. Vincent's Hospital, associated with Dr. Ralph C. Walker, with offices in the Stevens Building.

Dr. J. W. Warren, Radiologist to the General Hospital at Calgary, Alberta, Canada, has resigned his post to take the position at Jubilee Hospital vacated by Dr. L. K. Poyntz.

Dr. C. Rundel Nelson has resigned his position as Medical Officer in charge of the Williamshead Quarantine Station to accept the position of Radiologist to St. Joseph's Hospital, Victoria, vacated by Dr. Poyntz, now of Portland, Ore.

Central Illinois Radiological Society.—At the annual meeting of the society, recently, Dr. James H. Finch, Champaign, was elected president; Dr. Harold Swanberg, Quincy, vice president, and Dr. Perry B. Goodwin, Peoria, secretary-treasurer.

Roentgenologists Elect.—At the recent annual meeting of the New England Roentgen Ray Society the following officers were elected: President, Dr. Patrick F. Butler, Boston; vice president, Dr. William A. LaField, Bridgeport, Conn., and secretary-treasurer, Dr. Alexander S. MacMillan, Boston.

Dr. James T. Case is on a tour of the Northwest with Dr. Malcolm T. McEachern and Dr. Craig of the American College of Surgeons. Dr. Case as a Surgeon-radiologist is giving a series of addresses to both the professional and lay audiences.

Dr. Richard Hayes has just returned from abroad, where he has been doing special work in Roentgenology. He received a diploma at Cambridge University, and spent some time at the London Hospital and the clinics at Erlangen.

The Northern Society for Medical Radiology, which is composed of representative men from Denmark, Finland, Norway, and Sweden, will hold its next meeting at Helsingfors, September, 1925. Dr. Albert Soiland has been elected an Honorary Member and expects to deliver an address at the next meeting.

The Iowa X-Ray Club, on October 2, held a meeting at the College Hospital, Ames, Iowa. Dr. D. M. Ghrist is chairman, and Dr. A. L. Yocom, Jr., is secretary. The following essayists contributed to the program:

"Dosage in Deep Therapy," A. W. Erskine, M.D., Cedar Rapids, Iowa.

"X-Ray Treatment of Enlarged Thymus in Children," J. F. Herrick, M.D., Ottumwa, Iowa.

"Report of a Unique Case of Splenomyelogenous Leukemia Treated with High Voltage X-Ray," R. F. Bellaire, M.D., Sioux City, Iowa.

"Practical Treatment of Breast Carcinoma," A. L. Yocom, Jr., M.D., Chariton, Iowa.

ABSTRACTS OF CURRENT LITERATURE

Bissell, Frank S.: A Comparison of Clinical and Roentgenological Observations in Pulmonary Tuberculosis. *Am. Jour. Roentgenol.*, 1923, x, 428.

The author's paper is based on a series of 114 cases examined for the U. S. Public Health Service in which a satisfactory examination was made both by himself and the examining physician. In this series both examinations (the roentgen and clinical) were positive in 59 cases, and negative in 15. In 4 cases the roentgen-ray examination was negative in which the clinical findings were positive for tuberculosis and in 36 cases both the roentgenographic and clinical diagnoses were indeterminate. The author stresses the point that the lung roentgenograms must be of the best quality and prepared according to a standard technique and also that a good deal of intensive study and large experience are essential in the correct interpretation of lung roentgenograms.

The author regards abnormal lung markings in the periphery of the upper lung field beyond the distribution of the terminal bronchi as being pathognomonic of tuberculosis; regardless of the location or type of tuberculosis it will produce changes in this lung field. If the tuberculosis is active, there are fine tubercle-like shadows, sometimes in the form of conglomerate patches, the lesions have a cloudy appearance and there is no perfectly normal lung area between them and the hilus. If, on the other hand, the disease is healed, arrested, or latent, the patches are less cloudy in ap-

pearance and the lung area around them appears relatively normal.

The author's observation led him to conclude that peribronchial infiltration was much more characteristic of other infections or irritants than of tuberculosis. Evidence of fibrosis, especially when it occurred in the upper lung fields, was accepted as pointing to a tuberculous infection.

Tuberculous cavities are, of course, pathognomonic of the disease but the author carefully ruled out bronchiectatic cavities, pulmonary abscess, and small circumscribed pneumothoraces before he made the diagnosis.

The author believes that the question of activity of a lesion can best be determined by clinical evidence and that the province of the X-ray examination is the determination of the site and extent of tuberculous lesions.

As concerning the roentgenological prognosis of the disease the author regards the following as being of importance:

1. The type of infiltration (discrete or conglomerate),
2. The extent of lung involvement,
3. The presence of old healed lesions in other parts of the lung,
4. The amount of fibrosis,
5. The presence of cavities and areas of caseous pneumonia.

In his reports he considers a negative diagnosis as being more reliable than a positive diagnosis, since other affections of the lung may simulate tuberculosis.

An indeterminate report is made in about 20 per cent of the cases since there are atypical changes in the lung fields which render a positive diagnosis inadvisable and a negative diagnosis dangerous, such as post-influenzal infiltrations, streptococus bronchopneumonias and certain cases of chronic pleurisy with pulmonary fibrosis.

In conclusion, the author states that the relative values of the various diagnostic procedures employed for the recognition of early tuberculosis are as follows: First, history and symptoms; second, roentgenograms; third, tuberculin test; fourth, examination, and fifth, laboratory tests.

K. S. DAVIS.

Taylor, R. G.: Roentgen Gastro-intestinal Studies of Patients with Chronic Deforming Arthritis. *Amer. Jour. Roentgenol.*, 1923, x, 424.

The purpose of this paper is to again call the attention of roentgenologists to the importance of roentgen studies in cases of deforming arthritis; to the value of the findings; and to the very distinct and easily demonstrative types of lesions that are almost invariably found in the gastro-intestinal tracts of these patients.

The author starts with the proposition that the cause of chronic deforming arthritis is an intestinal infection, and the roentgen studies have been made on this basis after test meals and enemata. It has been observed that the majority of these patients have a type of colon characterized by its abnormal length and abnormal mobility. Nearly all cases that have become chronic show so-called surgical lesions in the right colon, in the ileum or in both. These lesions consist of adventitious bands similar to Jackson's membrane, involving the colon usually above the ileocecal valve, and occasionally involving the ileum, producing the so-called Lane's kink, or chronic appendicitis, etc. The author believes that these bands are congenital, or are developmental processes, the result of the abnormal mobility of the right colon. Some of them may be the result of local inflammatory processes. Their result is a crippling of the intestine which is evidenced roentgenologically by certain deformities in the barium shadow and evidence of torsion or twisting or kinking of the gut with resulting constriction; also in a percentage of cases by definite local stasis. In connection with the theory of intestinal infection it seems reasonable to believe that local stasis distinctly favors infection. The interest of the roentgenologist consists in the demonstration of the lesions which are probably responsible for the crippling and stasis.

The intestinal conditions must be rectified before marked permanent improvement in the local conditions can be expected.

Portis, M. M., and Portis, S. A.: Carcinoma of the Small Bowel. *Amer. Jour. Roentgenol.*, 1923, x, 419.

Carcinoma of the small bowel is rare and comprises only 3 per cent of intestinal carcinomata. It is of three types: part of a local or general intestinal polyposis; multiple or single benign embryonal carcinoid tumors which are usually found in the ileum and jejunum; localized adenocarcinomata, the majority being cases of this type.

The triad of symptoms which are of diagnostic value is a stubborn constipation with or without alternating diarrhea, severe attacks of colicky pain, and vomiting; the stools show

occult blood. Objectively with developing stenosis there are tympanites, visible peristalsis, and a tumor may be palpated. The X-ray is of great help in the diagnosis. A normal stomach and duodenal bulb help to rule them out as a cause for the occult blood. The duodenum is usually dilated and likewise the small bowel proximal to the stenosing tumor. Gas and fluid are found in the dilated bowel.

Two cases are reported by the authors. In the first the X-ray showed a normal stomach and duodenal bulb, but there was a delay in the emptying time. Duodenum was dilated and also the jejunum proximal to a definite constriction in it. On operation a ring carcinoma of the jejunum was found near the duodenum. In the second case the X-ray showed the stomach in a transverse position but the findings were otherwise normal. The duodenum was dilated. The small bowel near the duodenum was filled, giving the appearance of a stomach with air space above a fluid level. The bowel at the point distal to the dilatation showed a definite constriction. Reversed peristalsis was seen in the dilated portion proximal to the constriction. The patient was operated upon for probable tumor of the jejunum. An annular carcinoma was found in the jejunum near the ileum.

These cases were largely recognized after excluding the stomach by laboratory and X-ray methods. The X-ray evidence is clean cut.

Saner, F. D.: Fracture-Separatum of the Lower Humeral Epiphysis. *Practitioner,* 1922, cix, 244.

Saner says that without an X-ray examination an accurate diagnosis of the fracture-separation of the lower humeral epiphysis is impossible. Roentgenograms in two planes, as well as comparison pictures of the sound limb, are necessary. The condition, which is the result of trauma, is most usually seen between the ages of six and twelve years.

The lesion may show either as a complete or partial separation of the humeral epiphysis with the development of a small fragment from the diaphisis remaining attached to the epiphysis, or the line of fracture may show just above the epiphyseal line, but more usually the line of fracture is through the condyles. This latter is the type more frequently met with and is due to indirect trauma.

Apart from its necessity otherwise, the X-ray examination is important, as manipulations for the purpose of diagnosis should be avoided.

Clark, J. G., and Keene, F. L.: The Treatment of Cancer of the Pelvic Organs with Moderate Irradiation. *Am. Jour. of Roentgenol.,* 1922, ix, 808.

In an article published in 1921 the authors dwelt comprehensively upon every phase of their experience in irradiation therapeutics of carcinoma of the pelvic organs. The further results of this treatment which they now report are but an extension of that series, which then comprised 313 cases but has now reached 412, leaving a sufficient number of survivors who have passed the 5-year limit to give them an approximate estimate as to what may be expected from the application of the smaller quantities of radium (100 mgm.) which they have routinely employed.

Ferry, G., and Ortscheit, E.: Fractures of the Surgical Neck of the Scapula (Fractures du col chirurgical de l'omoplate). *Arch. Franco-Belg. de chir.,* 1922, xxv, 726.

Isolated fractures of the surgical neck of the scapula are rare lesions. They may be either complete or incomplete, and of both varieties only about 20 cases have been reported in the literature, according to the authors. Upward displacement of the distal fragment is very rare. The diagnosis in the case reported by the authors, which was the result of a fall, was rendered possible by the radiologic findings which showed that the tract of fracture started from the coracoid notch, traversed the supraspinous fossa vertically and was directed toward the subspinous fossa where it described a curve with supraexternal concavity toward the edge of the axilla on the right side. The fracture ended at 5 cms. beneath the subglenoid tubercle. The distal fragment was directed upward and backward.